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A Histological Examination of the Ovaries of Pacific Sanddab, *Citharichthys sordidus*, Captured at Two Oil Platforms and Two Natural Sites in the Southern California Bight

Milton S. Love

Marine Science Institute, University of California, Santa Barbara, CA 93106, 805 893-2935, love@lifesci.ucsb.edu

Stephen R. Goldberg

Department of Biology, Whittier College, 13406 E. Philadelphia St., Whittier, CA 90608

Abstract.—A number of the 26 offshore oil and gas platforms off California may be nearing the end of their economic lives. Decisions as to the disposition of these platforms will be based on a number of parameters, including the biological role of the structures. One issue that has arisen is the possible contamination of fishes living around platforms resulting from contaminants released during drilling and production. If significant contamination is occurring, it would be expected to impair the reproductive abilities of impacted fishes. One form of reproductive impairment is atresia, the abnormal reabsorption of oocytes that are destined to be spawned. Atresia has been widely used as an indicator of pollutant-related reproductive impairment in fishes. We examined the occurrence of atretic oocytes in Pacific sanddab, *Citharichthys sordidus*, collected near two offshore platforms in the Santa Barbara Channel (B and Gilda) and from two natural reference sites (off the east end of Santa Cruz Island and in mid-channel off Rincon). While pronounced atresia was observed in a few fish at one natural site and one platform, there was no evidence of widespread pronounced atresia at any of the four sites.

There are 26 offshore oil and gas platforms in California waters, many of which may be nearing the ends of their economic life spans. Following the decision by an operator to cease production, the process by which a decision is made as to the disposition of a platform is called decommissioning. This procedure may take into consideration the biological, sociological, and economic consequences of various decommissioning options, which range from leaving the entire structure in place through partial or total removal (Schroeder and Love 2004).

Among the issues that need to be addressed in this process is the possible contamination of platform-dwelling organisms. A number of activities associated with the production of oil and gas result in the creation of contaminants. Drilling muds (used to lubricate drill bits), drill cuttings (the hard material brought up by the drill bit), the water associated with the petroleum produced ("produced water"), and water used as coolant contain a variety of elements and compounds, including petroleum hydrocarbons (such as polycyclic aromatic hydrocarbons (PAHs)) and metals (Utvik 1999; Neff 2002; Steinberger et al. 2004). At least some of these elements and compounds are released into the water and may be deposited on the sea floor around these structures (Grant and

Briggs 2002; Phillips et al. 2006). While the acute toxicity of these materials varies considerably among both platforms and organisms (Utvik 1999; Grant and Briggs 2002), less is known about their potential chronic effects (Stephens et al. 2000).

One issue to be addressed during decommissioning is the possible damage to fish reproduction, by pollutants, if a structure is left in place. Pollutants such as heavy metals, PAHs, and chlorinated hydrocarbons have been linked to a range of physiological problems in fishes, including reproductive impairment (Hose et al. 1989; Cross and Hose 1988; Thomas 1989). One form of reproductive impairment linked to pollution is atresia, the abnormal reabsorption of oocytes destined to be spawned. Atresia has been used as an indicator of pollutant-related reproductive impairment in fish living in the southern California Bight (Cross et al. 1984).

The objective of this investigation was to compare the spawning capability, as measured by pronounced atresia, of Pacific sanddab (*Citharichthys sordidus*) living around two oil platforms with fish inhabiting two natural areas. This species occurs from the western Gulf of Alaska to Bahia Magdalena, southern Baja California, and as an isolated population in the Gulf of California (Love et al. 2005). Pacific sanddab are very widespread throughout southern California waters and live both on soft sea floors at natural sites and around oil and gas platforms (Love et al. 1999; Allen et al. 2007). This flatfish spends much of its time lying on or partially covered in sediment, although we have also seen them well up in the water column. It is an opportunistic feeder, preying on such benthic infauna as polychaetes, as well as such benthic, epibenthic, and water column organisms including shrimps, gammarid amphipods, mysids, euphausiids, squids, and fishes (Allen 1982; Allen et al. 2002). Pacific sanddab spawn from late spring through late fall, probably peaking in the summer (Arora 1951; M. McCrea, pers. comm.). The pattern of chlorinated hydrocarbon contamination of Pacific sanddab in the Southern California Bight, which demonstrates high levels only around the Palos Verdes Whites Point Outfall (a significant source of contamination), implies that these fish do not make large-scale movements (Schiff and Allen 2000).

Based on its life history, it would be expected that the Pacific sanddab is an excellent species on which to model the reproductive effects of platform discharges. This fish is likely to come into contact with benthic pollutants, both through direct physical contact and absorption, and from its diet of both sea-floor infauna and epibenthic organisms. In fact, Pacific sanddab have been shown to bioaccumulate pollutants and have been used as tools to assess levels of tissue contamination (Schiff and Allen 2000; Allen et al. 2002) and to determine sources of pollution (Parnell et al. 2008).

Methods

Pacific sanddab were collected at four sites in the Santa Barbara Channel, southern California, by hook and line in September 2005 (Fig. 1, Table 1). The sampling sites were 1) Platform B, 2) Platform Gilda 3) a natural site located about 8 km offshore and southeast of Platform B ("Rincon"), and 4) a natural site off the northeast corner of Santa Cruz Island ("Santa Cruz Island"). Both platforms have produced oil and gas for many years, Platform B starting in 1968 and Platform Gilda in 1981 (Love et al. 2003). Platform fish were collected within 30–60 m of each structure.

After capture, fish were placed on ice and several hours later were measured (total length, cm), the ovaries fixed in 10% formalin, and later shipped to Dr. Stephen R. Goldberg. A section of each ovary was removed, dehydrated in ethanol of ascending concentrations, embedded in paraffin and serial sections were cut at 5 μm using a rotary

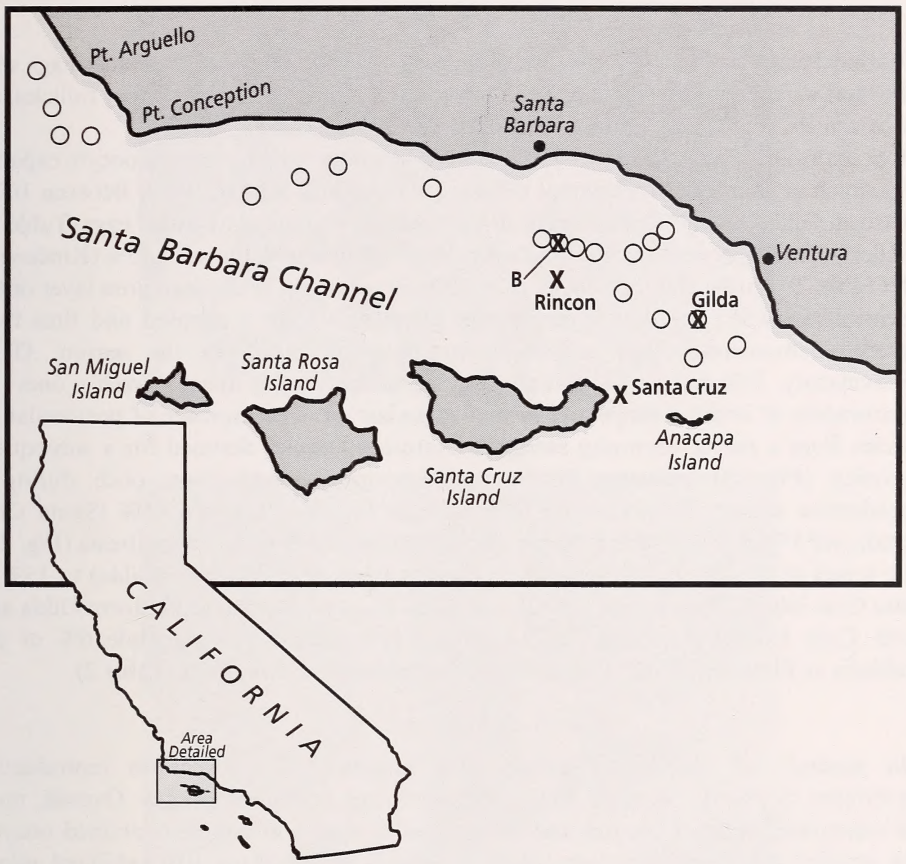

Fig. 1. The location of the four Pacific sanddab sampling sites (latitudes and longitudes listed in Table 1). Circles represent all of the platforms off California and those with an "x" inside are the two study platforms.

microtome. Sections were mounted on glass slides, stained with hematoxylin followed by eosin counterstain. Slides from each ovary were examined under a compound microscope. The presence of the following was noted: (1) hydrated eggs for upcoming spawning; (2) vitellogenesis (yolk deposition) in mode of smaller eggs for subsequent spawning; (3) postovulatory follicles (evidence of recent spawning); (4) follicular atresia (degenerating oocytes). Atresia was characterized as minor (<10% of eggs atretic) or pronounced (≥10% of eggs atretic) (Cross et al. 1984; McDermott et al. 2007).

Table 1. Details of Pacific sanddab, *Citharichthys sordidus*, collections made between 11 and 20 September 2005 in the Santa Barbara Channel.

Site	Date	Depth (m)	Location	n	TL (cm) ±SD
Platform B	11 Sept.	61 m	34°19′56″ 119°37′18	18	16.1±1.6
Rincon	16 Sept.	87 m	34°15′21″ 119·33′14″	19	19.3±4.8
Platform Gilda	20 Sept.	64 m	34°10′56″ 119°25′09″	20	20.8±2.6
Santa Cruz I.	20 Sept.	64 m	34°01′48″ 119°30′22″	21	20.7±3.4

Results

Within Pacific sanddab ovaries, we observed (1) hydrated eggs, (2) smaller eggs with yolks that would later grow and hydrate prior to spawning, (3) postovulatory follicles, (4) minor atresia, and (5) pronounced atresia (Figs. 2A–C, Table 2).

Egg hydration (Fig. 2A) occurs just prior to spawning, when a mature oocyte expands to as much as four times its original volume (Wallace and Selman 1981). Between 100% (Platform Gilda) and 50% (Rincon) of fish at each site contained hydrated eggs (Table 2). Smaller yolked eggs were found in between 100% (Platform Gilda) and 55% (Rincon) of fish (Table 2). Postovulatory follicles (Fig. 2B) are remnants of the granulosa layer of the previously spawned egg that hypertrophies after the oocyte is released and thus their presence demonstrates that a female has spawned earlier in the season. Older postovulatory follicles (> 24 hours) can be distinguished from "fresh" ones by deterioration of original shape and loss of organization. The presence of postovulatory follicles from a recent spawning alongside maturing follicles destined for a subsequent spawning (Fig. 2B) indicates Pacific sanddab spawn more than once during a reproductive season. Postovulatory follicles were found in between 65% (Santa Cruz Island) and 5% (Rincon) of fish (Table 2). At least some fish with minor atresia (Fig. 2C) were noted at all of the sites, with levels ranging from 60% (Platform Gilda) to 15% at Santa Cruz Island. Pronounced atresia was relatively rare. No fish at Platform Gilda and Santa Cruz Island were identified as having pronounced atresia, while 6% of the sanddabs at Platform B and 16% at Rincon exhibited this condition (Table 2).

Discussion

In general, we observed relatively little evidence of conspicuous reproductive impairment in Pacific sanddab from both platforms and natural sites. Overall, most fish contained hydrated oocytes and were about to spawn and most contained oocytes with smaller yolks and thus were likely to spawn again. Many fish exhibited minor atresia. Atresia is the spontaneous degeneration of an oocyte at any stage in its development and it occurs at low frequency throughout the ovarian cycle. For instance, background (i.e., non-test) levels of minor atresia in laboratory-raised zebrafish, *Danio rerio*, were 58% (Rossteuscher et al. 2008). The frequency of minor atresia typically increases toward the end of the spawning cycle when follicles that initiated, but did not complete, yolk deposition degenerate (Goldberg, 1981). The lack of any evidence of substantial reproductive impairment in fish living around two oil and gas platforms implies that large-scale reproductive damage is unlikely to be occurring.

We observed relatively few instances of pronounced atresia, a condition that is only occasionally observed in unstressed populations. As an example, pronounced atresia was only found in 2% of female Atka mackerel, *Pleurogrammus monopterygius*, taken from the relatively pristine Aleutian Islands (McDermott et al. 2007). A wide range of environmental stressors, including heavy metals (Pierron et al. 2008), endocrine disrupters (Pollino et al. 2007), and starvation and lipid-poor diets (Hunter and Macewicz 1985; Sherwood et al. 2007) can cause pronounced atresia. The level of pronounced atresia we documented was much less than that found in a study of longspine combfish, *Zaniolepis latipinnis*, and yellowchin sculpin, *Icelinus quadriseriatus*, from the vicinity of sewage outfalls in Santa Monica Bay and off Palos Verdes, southern California, or from a control site in Santa Monica Bay (Cross et al. 1984). That study documented high levels of pronounced atresia in 28–49% of females from around sewage outfalls and 42–44% from a control site (that was apparently also heavily polluted).

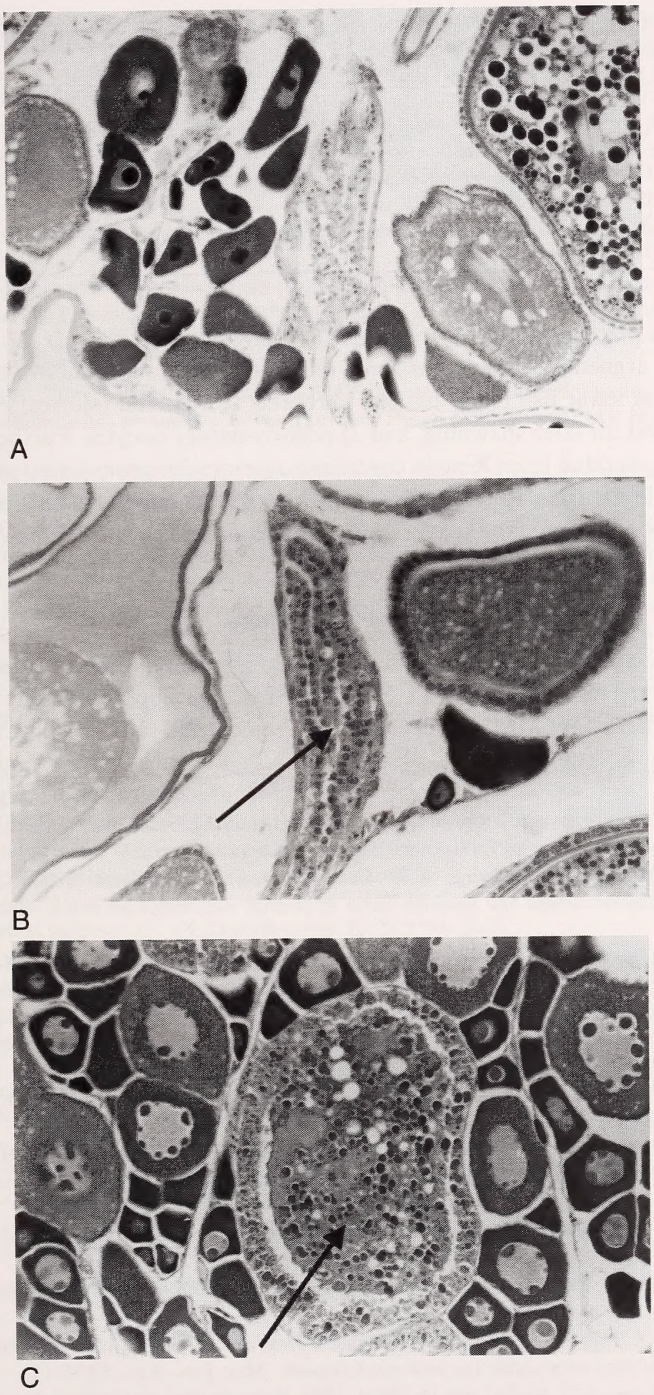

Fig. 2. A) Ovary of Pacific sanddab showing older postovulatory follicle (center); B) ovary of Pacific sanddab showing hydrated oocyte (left), yolk deposition in follicle (lower right), and fresh postovulatory follicle in center; C) ovary of Pacific sanddab showing atretic follicle (center). Note enlarged height of granulosa cell layer and ingested yolk granules. All images at 160 ×.

Table 2. Histological analyses of Pacific sanddab ovaries from four sites in the Santa Barbara Channel. Values in each column are in percentages of individuals sampled.

Site	n	Hydrated eggs	Yolk in smaller modes	Post-ovulatory follicles	Minor atresia	Pronounced atresia
B	18	95	95	61	22	6
Rincon	19	50	55	5	35	16
Gilda	20	100	100	35	60	0
SCI	21	85	85	65	15	0

It might be argued that there was some reduction in the reproductive capacity of fish from Rincon as fewer fish from that site harbored 1) hydrated oocytes, 2) those smaller oocytes destined for later spawning, and 3) post-ovulatory oocytes. Furthermore, 16% of female Pacific sanddab from Rincon contained ovaries with pronounced atresia. We note that our sample size from Rincon was relatively small, encompassed only one month, and the factors responsible for the reduction in ovarian output in these females remain to be determined.

Acknowledgments

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An Updated Catalogue of the Birds from the Carpinteria Asphalt, Pleistocene of California

Daniel A. Guthrie

Joint Science Department of Claremont McKenna, Scripps and Pitzer Colleges, Claremont Ca. 91711, dguthrie@jsd.claremont.edu

Abstract.—Published accounts of the Carpinteria avifauna, collected from an upper Pleistocene asphalt deposit near Carpinteria, California, were based on only a small portion of the collection. The present paper is a complete review of the avifauna, including information on previously unpublished and unidentified material. The avifauna contains 79 species, twenty-seven of which have been added to the published avifauna from the deposits. Included among these are the first fossil records of *Rallus limicola*, *Tringa melanoleuca*, *Tyrannus verticalis*, and *Piranga ludoviciana*. Specimens from the deposit previously assigned to *Corvus caurinus* are referred to *C. brachyrhynchos*.

In 1927, bones were found in an asphalt deposit near Carpinteria, California, that was being mined for paving material, and a collection was made in the same year by Chester Stock for the California Institute of Technology. This collection, from a limited area designated Pit 1, is now at the Natural History Museum of Los Angeles County (LACM). A second collection from a nearby area, designated Pit 2, was made for the Santa Barbara Museum of Natural History (SBMNH) in 1930 by David Rogers (L. Miller 1933). These collecting efforts removed all fossil material from the site and subsequent mining completely removed the asphalt deposit.

The birds from the deposit were described in three papers. The non-passerine material plus raven in both collections was the subject of a preliminary faunal list and later review by Loye Miller (1927, 1931). The passerine material at SBMNH was reviewed by Alden Miller (1932). Both authors listed the number of bones known for each species but indicated that there was additional identifiable material. Subsequent publications listing the Carpinteria avifauna (Miller and DeMay1942; Jefferson 1991) are based on these publications. Subsequent to 1933 Loye Miller and Hildegarde Howard identified additional material in the LACM collection and Ida DeMay and Hildegarde Howard identified additional material in the SBMNH collection, but none of these identifications were published.

In 2004, Paul Collins of SBMNH suggested I catalogue their Carpinteria collection. Examination of this collection and the material at LACM showed that both collections contained much additional identified material not listed in the Miller publications, as well as a large amount of hitherto unidentified material. Also, except for 9 specimens retained by Alden Miller and catalogued at the University of California Museum of Paleontology, Berkeley (UCMP), none of the collection has ever been catalogued (In a letter dated 1932 A. Miller stated that he was retaining 10 specimens, including a bone of *Cyanocitta*, but no such specimen exists in the UCMP catalogue). The current study involved cataloguing the SBMNH collection and examination and tabulation of all material in both the SBMNH and LACM collections. The LACM material is still uncatalogued. During this

study some additional material was identified and most earlier identifications were checked for accuracy. The following paper presents an updated catalogue of the Carpinteria material.

Table 1 lists the known avifauna from the Carpinteria asphalt deposit. Separate columns indicate the number of species and specimens identified by L. Miller in his 1927 and 1931 publications and by A. Miller in 1932. Alden Miller stated that 315 passerine bones had been recovered, but that only 169 were identifiable, of which he identified 94 (1932). Loye Miller's initial publication (1927) listed 80 identified specimens of non-passerine birds plus raven, while in his 1931 publication he stated that 540 bones had been identified, but he listed 704 specimens identified to species, plus 13 identified only to genus and 356 referred to unidentified raptors. The avifauna listed in the A. Miller and L. Miller publications contained 56 species. Included in this list were three specimens, referred to *Catharus (Hylocichla)* sp., *Empidonax* sp., and to an unidentified flycatcher, that could not be found in the collections. Also included were specimens referred to *Sayornis* and *Dryobates* that I have reclassified as *Tyrannus* and *Sphyrapicus*.

The current study adds 27 species to this list, 9 identified subsequent to the earlier publications by Loye Miller, Ida DeMay and Hildegarde Howard, and 18 identified by me, giving a total avifauna of 79 species. Most of the identifications by previous authors have been confirmed, and are mentioned here only in Table 1. Comments on species not previously listed for the Carpinteria asphalt, or where there is some question as to previous identification appear below. The number of identified bones is near 2000 (Table 1) and there are an additional 800 unidentified passerine bones, mostly broken, and nearly 1000 bones of raptoral birds unidentified as to species.

Pelicaniformes

A left scapula in the LACM collection was identified as *Pelicanus occidentalis* by Loye Miller.

Anseriformes

Chen caerulescens

Loye Miller (1931) referred a proximal left tarsometatarsus in the LACM collection to *Chen*, but did not identify the specimen to species. Now that Snow and Blue Geese have been merged into a single species, this specimen can be safely identified as *C. caerulescens*.

Anas platyrhynchos

Several bones in the LACM collection have been referred to this species, even though they vary widely in size. Mallards in modern collections also vary widely in size. Part of this is due to sexual dimorphism, but part also may be due to a difference in size between migrant populations from northern areas and resident non-migratory populations.

Anas sp. *cf. A. strepera*

A right distal tibiotarsus and complete left tarsometatarsus (SBMNH 750) agree in all respects to bones of this species. Both bones are too large for *Anas acuta*, *A clypeata*, *A Americana*, *Aythya americana* and *A.affinis* and are slightly small for *Anas platyrhynchos*, to which the tarsometatarsus was originally referred.

Table 1. Counts of bones from the Carpinteria asphalt deposits. Names in parentheses were used in original papers.

	Number of bones				
	Loye Miller counts	1931	A.Miller	Current counts in collections	
Species	LACM	SBMNH	1932	At UCMP	LACM SBNMH
Pelecanus occidentalis	0	0		1	0
Ciconia maltha	14	3		16	4
Chen caeulescens (Chen?)	1	0		1	0
Anas platyrhynchos	2	1		5	1
Anas strepera	0	0		0	2
Anas americana	0	0		0	1
Anas crecca	0	0		0	5
Cathartes aura	1	3		14	11
Gymnogyps amplus (californianus)	4	5		1	4
Coragyps (Catharista) occidentalis	2	0		0	4
Teratornis merriami	6	3		4	34
Haliaetus leucocephalus	0	7		15	57
Circus cyaneus (hudsonius)	0	1		0	2
Accipiter striatus (velox)	0	1		0	9
Accipiter cooperi	2	3		50	32
Accipiter gentilis (Astur atricapillus)	7	0		10	0
Buteogallus (Geranoaetus) fragilis	5	1?		51	54
Buteo lineatus	12	0		52	23
Buteo jamaicensis (borealis)	50	39		137	208
Buteo regalis	0	0		68	11
Buteo cf. *B. lagopus*	0	0		0	13
Buteo sp.	1	5		0	0
Amplibuteo (Morphnus) woodwardi	0	0		0	1
Wetmoregyps daggetti	4	1		24	12
Nephrontops americanus	0	0		8	2
Neogyps errans	3	9		120	77
Aquila chrysaetos	1	5		50	65
Spizaetus (Geranoaetus) grinnelli	3	12		44	43
Caracara (Polyborus) plancus	2	7		33	49
Falco sparverius	4	22		42	49
Falco cf. *F. columbarius*	0	0		0	1
Calipepla (Lophortyx) californica	11	24		44	78
Meleagris (Parapavo) californicus	136	112		228	155
Patagioenas (Columba) fasciata	1	1		3	3
Zenaidura macroura				1	
Rallus limicola					1
Tringa melanoleuca					1
Tyto alba (Aluco pratincola)	1	0		3	
Strix brea				10	8
Asio otus (wilsonianus)	0	5		5	8
Otus kennicottii (asio)	0	4		12	24
Bubo virginianus	20	27		72	87

Table 1. Continued.

	Number of bones					
	Loye Miller counts	1931	A.Miller	Current counts in collections		
Species	LACM	SBMNH	1932	At UCMP	LACM	SBNMH
Glaucidium gnoma	0	19			3	23
Phalenoptilus nuttalli					2	1
Melanerpes formicivorus						12
Melanerpes lewisi					10	6
Colaptes auratis (cafer)	2	23			19	80
Sphyrapicus sp.						11
Picoides villosus						1
Dryobates sp.	0	6			0	0
Geococcyx californianus	27	10			49	37
Sayornis			1			0
Empidonax			1			0
Tyrannus verticallis						1
indet flycatcher			1			
Lanius ludovicianus					1	2
Cyanocitta stelleri			4		15	3
Aphelocoma californica			30	1	45	108
Pica nutallii			3			6
Corvus corax	17	17			46	42
Corvus brachyrhynchos (caurinus)			21 or 30	1	59	38
Tachycineta sp. cf. *T. bicolor*					1	
Petrochelidon pyrrhonota						1
Poecile sp. *(Penthestes)*			2			1
Sitta canadensis			1			3
Sitta pygmaea			3	1		2
Regulus sp.			3	1		2
Sialia mexicana			12	1		11
Catharus sp. *(Hylocichla)*			1			
Turdus migratorius			11			8
Ixoreus naevius						5
Chamaea fasciata			2	1		1
Bombycilla cedrorum			2			1
Dendroica sp.						1
Piranga ludoviciana						1
Pipilo maculatus			1			1
Pipilo crissalis (fuscus)			5	1		6
Pipilo sp. cf. *P. angelensis*						1
Passerella iliaca			1			
Zonotricha sp, cf. *Z. leucophrys*						2
Sturnella neglecta			4	1	4	5
Xanthocephalus xanthocephalus						8
Loxia curvirostra			5	1		4
Carduelis (Spinus) pinus			1			
unidentified raptoral bird bones	160	196			400+	400+
unidentified passerine bones					106	800
total of identified bones.	499	571	94	9	1484	2374

Anas americana

This species is represented in the collection by a right humerus (SBMNH 751), complete except for its proximal end. The humerus is too short for *Anas Acuta*, *A strepera*, *A. platyrhynchos* and *Aythyra americana* and too slender for *Anas clypeata*. A well defined brachial depression separates this bone from those of *Aythya americana*..

Anas crecca

A small duck is represented by two proximal humeri, two distal coracoids and a carpometacarpus (SBMNH 752). The humeri lack the ridge posterior to the pectoral attachment that is found in *Oxyura jamaicensis*, are too short for *Bucephala albeola* and *Anas cyanoptera* and not as robust as *Anas discors*. The coracoids are small and fit this species better than other teal.

Falconiformes

No attempt was made to check identifications of extinct species. Loye Miller's original list of specimens listed over 300 bones not referred to species. Most of these were subsequently identified to species by Loye Miller and by Ida DeMay and labeled in the collections. Two additions were made by these researchers to the original list. These were *Nephrontops americanus* and *Amplibuteo (Morphnus) woodwardi*, both of which occur at Rancho la Brea. Two bones of *Coragyps occidentalis*, reported by Miller (1931) to be in the LACM collection, could not be found, although four bones referred to this species are in the SBMNH collection (no. 748). Reassignment of bones after publication may account for small decreases in numbers of bones for *Gymnogyps* and *Teratornis*. Recent work by Syverson (2007) indicates that *Gymnogyps amplus* is the correct name for the Rancho La Brea Condor.

The original publications listed only *Buteo lineatus* and *B. jamaicensis* within *Buteo*. Subsequently, many bones were identified as *B. regalis* at LACM by L. Miller and at SBMNH by Ida Deay. *Buteo regalis* is clearly larger than *B jamaicensis*, but some of the specimens assigned to *B. regalis* are even more robust than this species and have been provisionally assigned to *Buteo* sp., cf. *B. lagopus*. A distal ulna of a falcon (SBMNH 770) seems slightly large for *Falco sparverius* and is here tentatively assigned to the slightly larger species *F. columbarius*.

Most of the unidentified accipitrine bones listed by Miller (1931) were major limb and shoulder girdle bones which have subsequently been identified. However, both the LACM and SBNHM collections still contain many elements of raptoral birds, both Falconiformes and Strigiformes that have not been identified. These consist mostly of the smaller foot bones (phalanges, claws) as well as pygiforms, quadrates and smaller wing bones. The total number of unidentified elements is about 1000.

Gruiformes

Rallus limicola

A proximal right humerus (SBMNH 771) is identical to modern material of this species and represents the first fossil specimen of this species other than material from Florida (Conway, 1995).

Charadriiformes

Tringa melanoleuca

A complete right coracoid (SBMNH 772) is identical to modern material of this species. This is the first fossil record for this species, which was previously known only from archeological sites (Elphick and Tibbitts 1998).

Columbiformes

Zenaida macroura

A humerus in the LACM collection was identified as this species by Loye Miller.

Strigiformes

Tyto alba

A complete right tibiotarsus, a right coracoid and a fragmentary furcula in the LACM collection were identified as this species by Loye Miller.

Strix brea

Several bones in the LACM collection were identified as this species by Robert McKenzie, a curatorial assistant to Hildegarde Howard. Howard (1933) described this species based on material from Rancho La Brea previously thought to belong to *Bubo virginianus*. Wing bones of *S. brea* are smaller than those in *B. virginianus*, while leg bones appear about the same size but are more gracile. Several bones in the SBMNH collection (No. 773) that were previously identified as *Bubo virginianus* are within the size range of *Strix brea* and are here referred to this species.

Caprimulgiformes

Phalaenoptilus nuttallii

Two proximal humeri in the LACM collection, (labeled as ?*Eudora (Charadrius) montanus* by Loye Miller) are referable here as is a proximal humerus in the SMBNH collection (No. 786).

Piciformes

Woodpeckers are well represented in the Carpinteria collections. Miller (1931) identified only *Colaptes auratus (cafer)* to species, but listed 6 bones as belonging to a small woodpecker that he referred to *Dryobates*. The LACM collection contains many specimens subsequently identified as *Melanerpes lewisi* by L. Miller, whereas, the SBMNH collection contains material identified as *M. formicivorous* (No. 781) by both Miller and Ida DeMay. Several mandibles and a cranium are clearly assignable to *M. formicivorous*. Although bones of *M. lewisi* are slightly more robust that those of *M. formicivorous*, confident assignment of elements to one or the other of these species must await a population study of the two species. Bones of smaller woodpeckers are referable to two species. A crania (SBMNH 783) agrees with *Picoides villosus* in size and configuration. Several other bones (SBMNH 784) are large for *P. villosus* and are tentatively assigned, primarily on the basis of size, to *Sphyrapicus*, but cannot be assigned to species within this genus. These include the bones assigned to Dryobates by Miller (1931).

Passeriformes

Alden Miller apparently only saw the passerines in the SBMNH collection as most of the bones of this group at LACM, although sorted, have not been identified. Miller also failed to identify much of the passerine material at SBMNH, in part, I suspect, due to a lack of comparative skeletal material [He noted (1927) that it was necessary to take bones out of skins in order to compare modern *Corvus caurinus* to fossil material]. My identifications are based on comparisons with extant species in southern California. The larger species, being fewer in number, were most easily identified. Many smaller bones, mostly broken and numbering about 800, still await assignment. The following are additions to or changes in the passerine list.

Tyrannidae

Tyrannus verticalis

A distal coracoid was identified by Alden Miller (1931) as *Sayornis* sp. It is definitely a flycatcher, but too large for *Sayornis nigra* or *S. saya*, and also too large for *Myiarchus cinerascens*. It appears identical in size and configuration to *Tyrannus verticalis*, and is too small to be referred to *T. vociferans*. This is the first fossil record of this species (Gamble and Bergin 1996). Miller (1931) also listed a carpometacarpus as *Empidonax* sp. and a lower jaw fragment as an indeterminate flycatcher. Neither specimen could be found in the collections.

Family Laniidae

Lanius ludovicianus

This species is represented by two mandibles and a coracoid in the SBMNH collections (No. 789) and by a tarsometatarsus at LACM. Loggerhead shrikes are also known from other Rancho La Brean sites in California and Wyoming (Brodkorb 1978; Emslie 1978).

Corvidae

This family includes the three most numerous passerine species in the Carpinteria asphalt. The Scrub jay (*Aphelocoma californica*) is the most common species in the collection. A few bones that seem slightly large for this species were referred to Steller's jay (*Cyanocitta stelleri*) by A. Miller. A magpie (presumably *Pica nuttallii* based on its location) is also represented by a small number of bones in the collections. Ravens (Corvus corax) are the second most common passerine in the collection and crows are the third most represented species.

Alden Miller (1929) identified two subspecies of crows from Rancho La Brea, *C. brachyrhynchos brachyrynchos* and *C. b. caurinus*. In his study of the Carpinteria passerines (1932) he found only the latter species and accepted the changes in taxonomy that elevated *C. caurinus* to specific level. Johnston (1961) and Rea (1986) doubted the validity of these reports of *C. caurinus* from the southern California Pleistocene. Miller (1929, 1932) had little available skeletal material of the two species and based his comparison mostly on measurements of bones in skins (tarsometatarsus). He stated that "The size difference between *C. b. hesperis* and *caurinus* is pronounced in the tarsometatarsi but is less distinct, even though appreciable, in the other elements of the skeleton." A Miller, 1932:175). Recent material of both *C. brachyrhynchos* and *C. caurinus* in the LACM Collections were measured and compared to the Carpinteria material. Measurements of the tarsometatarus from Carpinteria are closer to *C.*

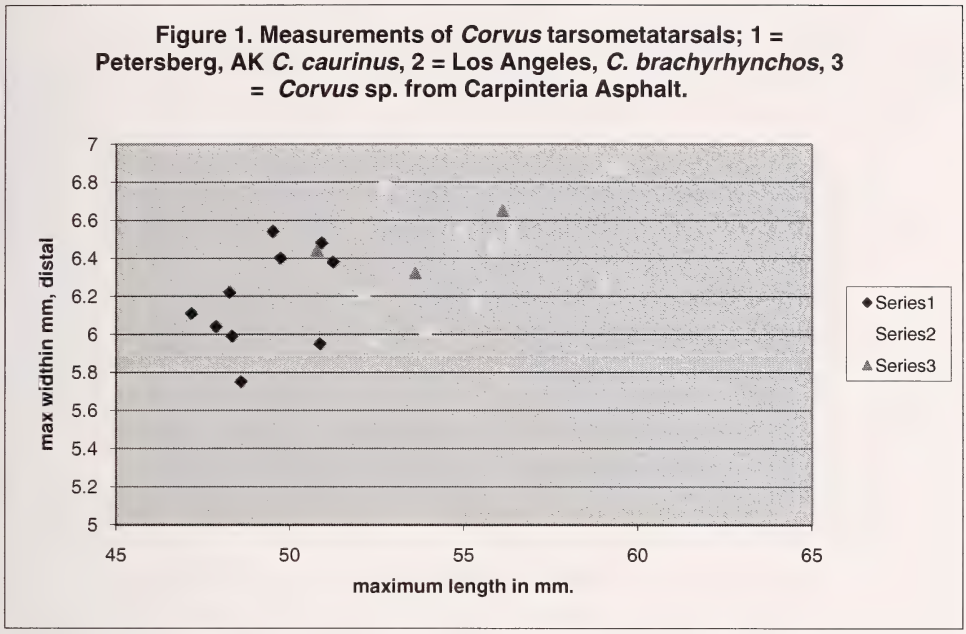

Fig. 1. Measurements of *Corvus* tarsometatarsals; 1 = Petersberg, AK *C. caurinus*, 2 = Los Angeles, *C. brachyrhynchos*, 3 = *Corvus* sp. from Carpinteria Asphalt.

brachyrhynchos from southern California than to *C. caurinus* from Petersburg, Alaska (Fig. 1). As both *C. brachyrhynchos* and *C. caurinus* were reported in the Rancho La Brea collections (A. Miller 1929), humeri of these specimens were also compared to Recent material (Fig. 2). The La Brea sample contains two species, based on size, but the smaller of the two is close to both living *C. brachyrhynchos* and *C. caurinus*, which are not differentialted based on the size of the humerus. The larger species from Rancho La Brea is bigger than living material of either of these species and probably represents a different taxon. Whatever the correct taxonomy of these two species, it seems clear that the Carpinteria sample of crows contains only one species, best referred to *C. brachyrhynchos*.

Hirundinidae

Two complete humeri in the collection are referable to swallow. The humeri of the different species of southern California swallows are very similar in form, differing only slightly in size. The two humeri are too large for *Riparia riparia* and *Stelgidopteryx serripennis* and too small for *Hirundo rustica*. The SBMNH specimen (No. 795) is identical to comparative material of *Petrochelidon pyrrhonota*. The LACM specimen is slightly smaller and the shaft is not as robust. This specimen may represent *Tachycineta*, probably *T. bicolor*. *Petrochelidon pyrrghonota* is known from the McKittrick Pleistocene of California (Miller and DeMay, 1942. There are no previous fossil records of *Tachycineta*. (Robinson et al. 1992; Brown et al. 1992).

Turdidae

Alden Miller (1932) identified several bones of a large thrush in the SBMNH collection (SBMNH 801) as *Turdus migratorius*. A mandible, humerus, carpometacarpus and

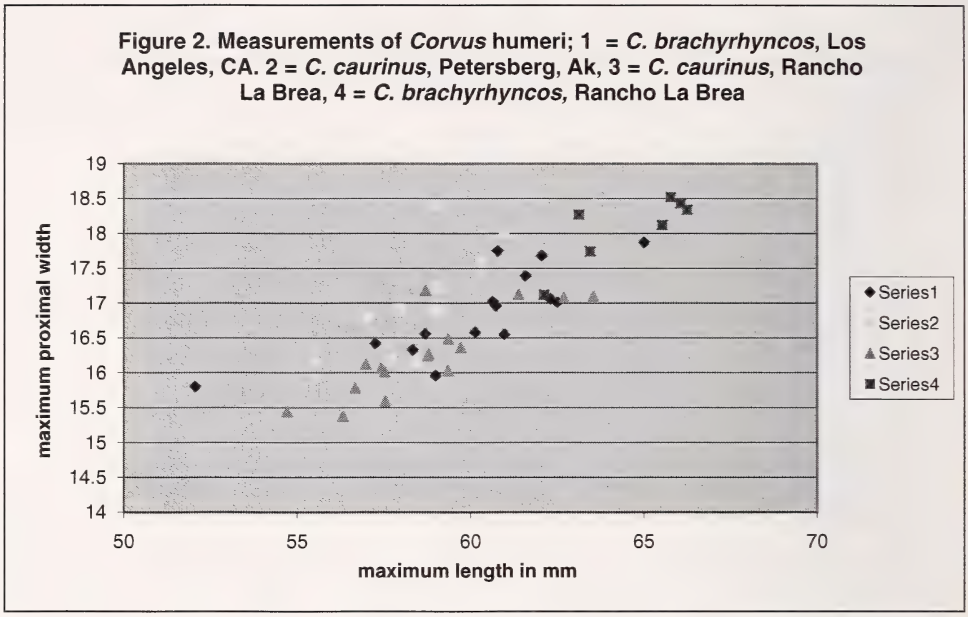

Fig. 2. Measurements of *Corvus* humeri; 1 = *C. brachyrhyncos*, Los Angeles, CA. 2 = *C. caurinus*, Petersberg, Ak, 3 = *C. caurinus*, Rancho La Brea, 4 = *C. brachyrhyncos*, Rancho La Brea.

coracoid, although nearly identical in configuration to *T. migratorius*, are small for this species and are here referred to *Ixoreus naevius*. Alden Miller (1932) also identified *Siala mexicana* and *Hylocichla* sp? within this family. The single specimen of the latter species could not be located.

Parulidae

A complete lower mandible (SBMNH 805) is identical to that of *Dendroica coronata*, but cannot be separated with certainty from other members of this genus that occur regularly in southern California.

Thraupidae

Piranga ludoviciana

This species is represented by a single maxilla (SBMNH 832). This is the first record of this species from the Pleistocene (Hudon 1999).

Emberizidae

Alden Miller (1932) identified *Pipilo maculatus* and *P. crissalis (fuscus)* in the Carpinteria material. Dawson (1948) recognized these two species at Rancho La Brea and described a third species, *P. angelensis*. Only maxillae and mandibles of these three species were identified in the Rancho La Brea collections, *P. angelensis* being larger than the two extant species. One tarsometatarsus (SBMNH 808) in the Carpinteria collection is slightly large for extant *Pipilo* and is here tentatively referred to *P. angelensis*. I have referred a mandible and tarsometatarsus to *Zonotricha* sp., cf. *Z.leucophrys* (SBMNH 810). This is the first record of this species from Carpinteria.

Icteridae

The only icterid identified by Miller (1932) was *Sturnella neglecta*. To the previously known limb material can be added a maxilla and mandible (SBMNH 811). A maxilla in the SBMNH collections and several limb bones (SBMNH 812) are identical in size to *Xanthocephalus xanthocephalus*. These bones are too big for other Californian icterids, including the blackbird described from La Brea as *Euphagus magnirostris*. *Xanthocephalus xanthocephalus* is known from other Pleistocene localities in California (Brodkorb 1978).

Discussion

The Carpinteria deposit has never been dated. However, the avifauna is similar to that found in the Rancho La Brea deposits, which date between 40,000 and 10,000 B.P. (Marcus and Berger 1984). Loye Miller's original analysis of the collection listed very few water birds. The current list of species, including pelican, several additional ducks, a rail, a shorebird, and a yellow-headed blackbird suggest a marshy area peripheral to the asphalt deposit. The large number of woodpeckers is consistent with a surrounding pine and oak woodland, as indicated by the preserved plant material (Chaney and Mason 1933). The non-avian portion of the Carpinteria collection, including amphibian, reptile and mammalian material was only reviewed through preliminary reports and awaits further review.

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Seabird Observations During Cetacean Surveys In Santa Monica Bay, California

Maddalena Bearzi, Charles A. Saylan, and Jon Feenstra

Ocean Conservation Society, P.O. Box 12860, Marina del Rey, California 90295

Abstract.—Seabird occurrence, distribution and behavior were assessed during cetacean surveys conducted between 2006–2007 in Santa Monica Bay, California. Gulls were most sighted year-round (55.63%), followed by brown pelicans (*Pelecanus occidentalis*; 19.0%), terns (6.61%) and Western grebes (*Aechmophorus occidentalis*; 6.53%). Gulls, shearwaters, and pelicans were often found foraging with short-beaked and long-beaked common dolphins (*Delphinus delphis*, *D. capensis*), and California sea lions (*Zalophus californianus*) near underwater canyons. Behavioral budget showed a predominance of *passing by* and *floating* activities. *Feeding* was observed in 6.5% of the sightings. This study provides baseline data for future seabird monitoring, conservation and management in the study area.

Over two million seabirds of almost thirty species nest along the California, Oregon, and Washington coasts, including three species listed as threatened and endangered: the brown pelican (*Pelecanus occidentalis*), the California least tern (*Sterna antillarum browni*), and the marbled murrelet (*Brachyramphus marmoratus*)(Bonnell and Dailey 1993). The Southern California Bight (SCB) also supports a large presence of seabirds, including 43 species (Bonnell and Dailey 1993) many of which move in and out of Santa Monica Bay. Species of gulls, terns, shearwaters and storm-petrels are the most numerous and all breed in the SCB (with the exception of shearwaters), many on the Channel Islands (Hunt et al. 1981, Carter et al. 1995, Schmitt and Bonnell 2003).

This study, conducted between 2006–2007, describes the occurrence, seasonal presence, distribution and behavior of seabirds occurring in the bay, and provides baseline data for future investigations and monitoring as well as for conservation and management of seabirds in Santa Monica Bay, currently considered as a potential Marine Protected Area.

Methods

Study Area

The Santa Monica Bay study area (approximately 460 km^2, Fig. 1) is a shallow shelf bounded by the Palos Verdes Peninsula to the South (33°45′ N, 118°24′ W), Point Dume to the North (33°59′ N, 118°48′ W) and the edge of the continental shelf to the West. The bay contains three submarine canyons: Dume and Redondo canyons head in shallow water, whereas Santa Monica Canyon begins at a depth of about 100 m at the edge of the continental shelf. The mean depth is about 55 m and the maximum depth 450 m. A shallow shelf between Santa Monica Canyon and Redondo Canyon extends as a plateau from the 50 m contour. Mild temperatures, short rainy winters and long, dry summers are usual weather conditions for the bay. Normal water surface temperatures range from 11 to 22 °C. During the 1997–98 El Niño, three peaks of sea surface temperature (SST)

Fig. 1. Study area and distribution of seabirds groups during 2006–2007.

anomalies were evident: May–June 1997, September–October 1997 and August 1998, with an increase in temperature of +2 °C (Nezlin et al., 2003).

Data Collection and Analyses

Seabird observations were conducted during cetacean surveys from January 2006 to July 2007. Inshore (distance from shore < 500 m) and offshore (distance from shore > 500 m) routes were carried out in the morning and early afternoon with Beaufort scale 2 or less, sea state 0 and visibility > 300 m. Routes, planned for an even coverage of the bay throughout the entire study period (Bearzi *et al.* 2008), were covered from a 17-m sailboat (2006) and a 10-m powerboat (2007), at an average speed of 18 km/h.

Data were recorded with a hand-held, PDA based system for seabird data collection specifically designed for this study (Bearzi and Saylan 2008). A total of 17 different groups of seabirds were taken into account, including: loons, grebes, fulmars and petrels, shearwaters, pelicans, cormorants, shorebirds, gulls and kittawakes, terns, skimmers, and alcids. When species were uncertain and/or categorized as threatened/endangered, their presence (and possibly identification) was also recorded in the database (Bearzi and Saylan 2008).

When seabirds were sighted, species/family, an estimate of total number of individuals, estimated distance from the boat, and behavior (e.g., passing by, inspecting, landing, floating, feeding) in presence or absence of cetaceans were recorded at five-minute intervals throughout the entire survey. Data analyses were performed using Statview 5.02, Statistica 6.0 and Microsoft Excel 2003; data on species distribution were plotted with Arcview GIS 9.2.

Note: Seabirds considered in this study include birds residing or spending a portion of their lives on or near coastal or offshore habitats. This study also includes all shorebirds

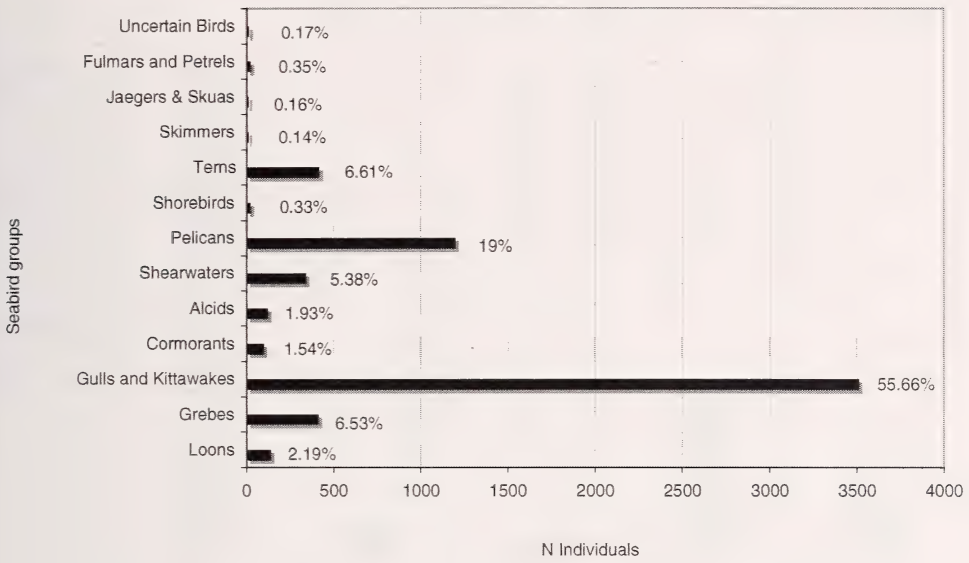

Fig. 2. Cumulative data for seabird groups observed for the entire study period.

observed during surveys conducted at sea; red and red-necked phalaropes (*Phalaropus fulicarius* and *P. lobatus*, respectively) are shorebirds that routinely spend portions of their non-breeding seasons at sea off Southern California (Garrett and Dunn 1981).

Results

Field Effort

Data were collected during 15 inshore and offshore surveys. Over 70 hours were spent searching for seabirds in good weather conditions (Beaufort scale ≤ 2), with similar effort in the two study years (2006: 36 hours; 2007: 34 hours). The majority of seabirds were recorded at a distance from the research boat of 0–50 m (36.5%), followed by those observed at 51–100 m (32.5%), 101–200 m (17.0%) and 201–300 m (14.0%).

Occurrence, Seasonal Presence and Distribution

On a total of 6306 individuals observed, gulls (family *Laridae*, genus *Larus*) were the most frequently sighted seabirds year-round in Santa Monica Bay (55.63%, $n = 3508$). The majority of gulls were Western gulls (*Larus occidentalis*), California gulls (*L. californicus*), ring-billed gulls (*L. delawarensis*), Heermann's gulls (*L. heermanni*), and Bonaparte gulls (*L. philadelphia*). Pelicans - all belonging to the species *P. occidentalis* - were the second group most often recorded (19.0%, $n = 1736$), followed by terns (6.61%, $n = 616$) and Western grebes (*Aechmophorus occidentalis*; 6.53%, $n = 412$; Fig. 2). While elegant terns (*Sterna elegans*) were observed both in coastal waters and offshore, the endangered California least terns (*S. a. browni*) were recorded typically during coastal surveys in the summer months. Shearwaters - mostly sooty shearwaters (*Puffinus griseus*) - were observed primarily during the summer months in the offshore waters of the bay (5.37%, $n = 339$). The presence of the Xantus's murrelet (*Synthliboramphus hypoleucus*) - a vulnerable species listed in the IUCN Red List of threatened species and a California Fish and Game Species of Special Concern - was also recorded during surveys in offshore waters. The seasonal presence of the different groups is illustrated in Figure 3.

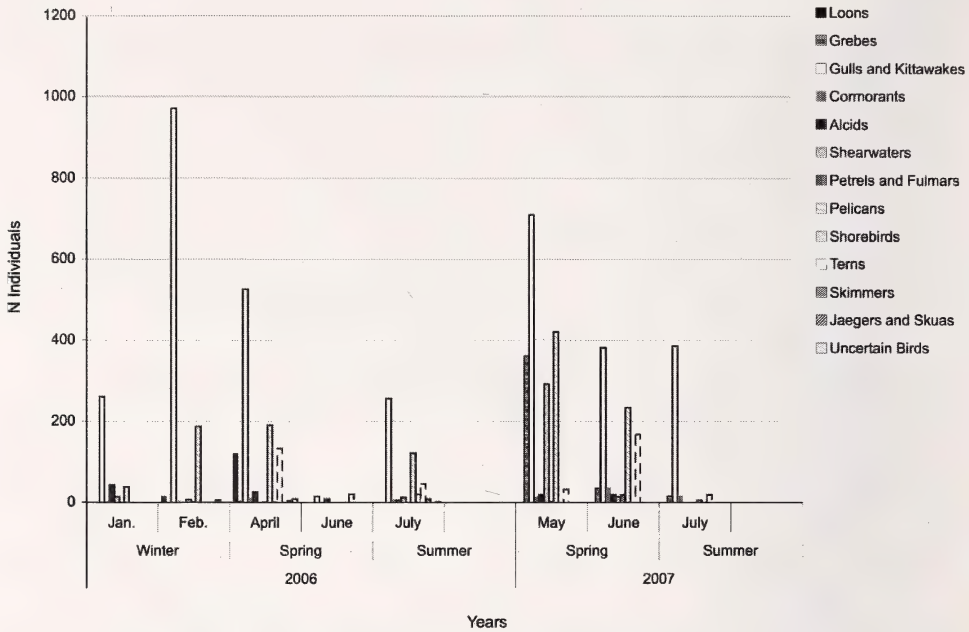

Fig. 3. Seasonal presence of seabird groups observed in Santa Monica Bay.

Seabirds were always recorded during inshore surveys (< 500 m from shore) but they were also observed during offshore surveys, with the exception of two days spent at sea (Fig. 1). In offshore waters and primarily along the Santa Monica canyon, seabirds like gulls, shearwaters, and brown pelicans were often found in aggregations with cetaceans (mostly short-beaked common dolphins, *Delphinus delphis*, and long-beaked common dolphins, *D. capensis*) and California sea lions (*Zalophus californianus*) during foraging and feeding activities.

Behavioral Patterns

On a total of 674 5-min samples, the behavioral budget recorded for different seabird groups showed a predominance of *passing by* (62.6%; *n* 5-min sample = 422), followed by *floating* (22.3%, *n* = 150) activities. *Feeding* was observed in 6.5% of the sightings (*n*=44), *boat inspecting* in 5.0% of the sightings (*n* = 34) and *landing* in 3.6% of the sightings (*n* = 24). The different behaviors displayed by the seabird groups are illustrated in Figure 4.

During cetacean sightings, on a total of 217 5-min samples, the behavioral budget recorded for different seabird groups showed a predominance of *inspecting cetaceans* (18.9%; *n* 5-min sample = 41), followed by *floating near cetaceans* (17.0%, *n* = 370) activities. *Feeding near cetaceans* was observed in 16.1% of the sightings (*n* = 35), and *landing near cetaceans* was recorded in 9.2% of the sightings (*n* = 20). Seabirds were also observed *stealing fish* from cetaceans in 6.9% of the sightings (*n* = 15). The different behaviors displayed by the seabird groups during cetacean sightings are illustrated in Figure 5. Preliminary observations also show seabirds usually approaching (and separating from) cetacean schools - and not *viceversa*; more data, however, is necessary to validate this hypothesis.

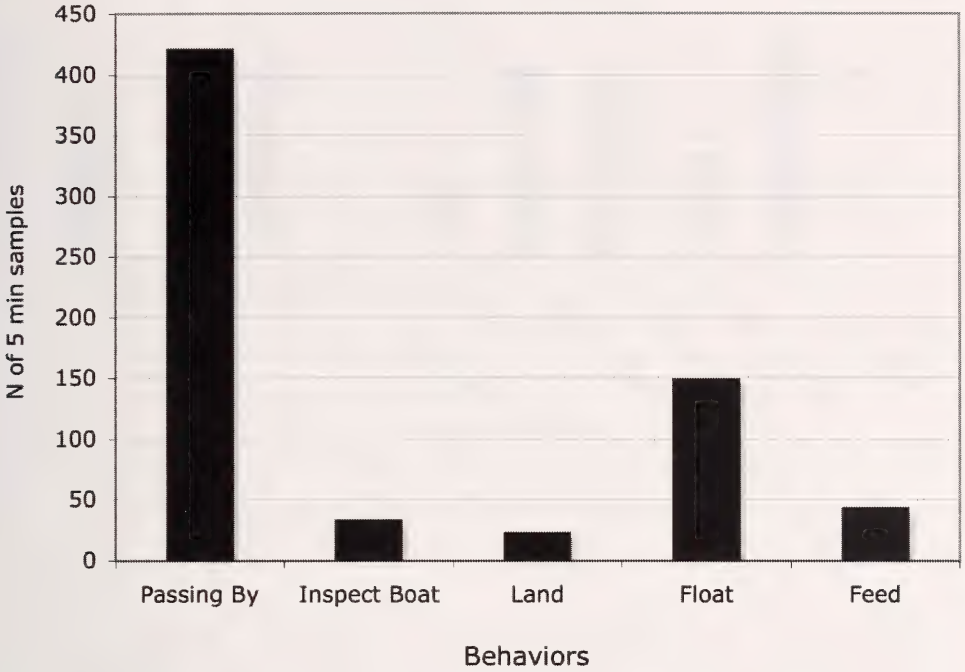

Fig. 4. Behaviors of seabird groups observed during 5-min intervals (n = 674).

Discussion

Although seabirds are mobile species and do not restrict their presence to a specific area (Bonnell and Dailey 1993), this preliminary study attempts to provide an overview of seabird occurrence, distribution and behavior in Santa Monica Bay, both in presence and absence of cetaceans.

Of the seabirds inhabiting Santa Monica Bay, gulls (family Laridae, genus *Larus*) were the most often observed year-round and during the two-year study period, followed by brown pelicans, terns, grebes and shearwaters. This data is in accordance with other studies conducted at a larger scale in the SCB (Garrett and Dunn 1981, Carter et al. 1995; Bonnell and Dailey 1993 for a general overview). The presence of brown pelicans, least terns and Xantus's murrelets, listed as vulnerable, threatened and endangered species and all recorded during on-the-water surveys, also reflects, in general and at smaller scale, the occurrence of these species as reported by other authors for the SCB (Bonnell and Dailey, 1993, Schmitt and Bonnell, 2003).

The occurrence of seabirds in the study area was recorded both within 500 m of shore and in the offshore waters of the bay with a high presence of birds near the Santa Monica canyon. Seabirds, like other top predators, are known to concentrate where ocean productivity is high (Bonnell and Dailey 1993); the canyons of the bay represent areas of upwelling - where the cold and nutrient-rich waters of the depth mix with surface waters – representing optimal foraging ground for different species (Evans 1980, Bearzi 2005, 2006).

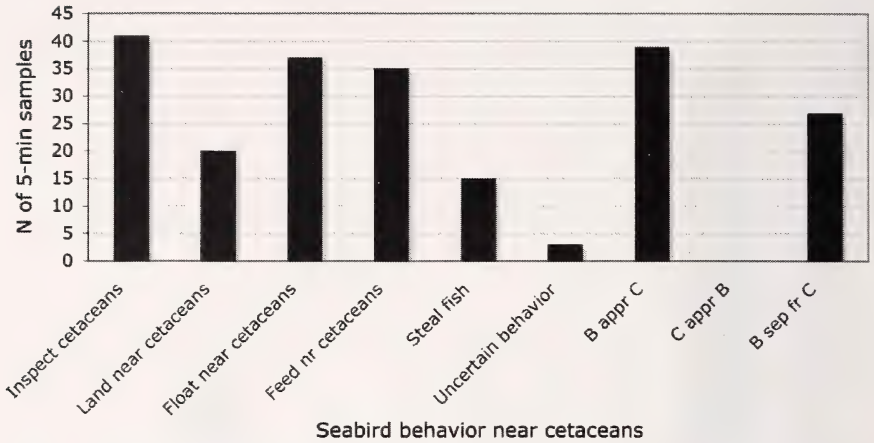

Fig. 5. Seabird behaviors displayed during cetacean sightings (B = birds; C = cetaceans).

Seabirds were often observed passing by, but feeding activities were also often recorded, especially along the Santa Monica submarine canyon and/or along fronts or slicks, usually in the presence of cetaceans and California sea lions, as also previously recorded by the author (Bearzi 2006). Many of the prey types eaten by seabirds are, in fact, the same species consumed by marine mammals (e.g., anchovies, sardines, mackerels, rockfish; Bonnell and Dailey 1993, Bearzi 2005, 2006).

Conclusion

Many seabird species use the bay on a year-round or seasonal basis; several of them are threatened, endangered, have a limited range or show a decline in their populations (Bonnell and Dailey 1993). Further, this study illustrates how seabirds – as well as cetaceans and sea lions - frequently occur along submarine canyons, areas where preys are usually abundant for top predators. These areas also tend to accumulate man-made pollutants like plastic, well known to be consumed by seabirds and occasionally causing the death of these animals (Fry 1987, Day 1979, Ryan 1990).

This preliminary study provides a baseline of data on seabird species and suggests the need to 1) gain a better understanding of linkages between different species (e.g., marine mammals, seabirds, fish populations) present in Santa Monica Bay; 2) utilize a precautionary approach toward these species; and 3) conduct continuous monitoring of seabirds and marine mammal species for their protection and management in Santa Monica Bay.

Acknowledgements

The field research was funded by the Santa Monica Bay Restoration Commission (2006–2007). Thanks to all the Los Angeles Dolphin Project assistants. Special acknowledgments to Cybertracker, ESRI, Maptech, and IFAW for the use of their software. Fieldwork was conducted following the laws of California and the General Authorization for Scientific Research issued by the National Oceanic and Atmospheric Administration (file # 8561835, Silver Spring, Maryland).

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ANNUAL MEETING

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

May 29–30, 2009

Marymount College

Rancho Palos Verdes, CA

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108(2), 2009, pp. 71–73
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Future SCAS Meetings

2010 – California State University, Los Angeles
2011 – California Polytechnic University, Pomona
2012 – Occidental College

Acknowledgements

The Southern California Academy of Sciences wishes to acknowledge the following organizations and people for their support of the 2009 Annual Meeting.

The Port of Los Angeles

Palos Verdes Land Conservancy

Marymount College

Special thanks to the SCAS 2009 Annual Meeting Local Committee at Marymount College: Ann Dalkey

SOUTHERN CALIFORNIA ACADEMY OF SCIENCES ANNUAL MEETING STUDENT PRESENTATION AWARDS

Over 40 students entered this year's competition for SCAS student-presentation awards. Awards were given in the categories of Biological and Physical Sciences for both posters and talks. Owing to the large number of student presentations in both categories of the Biological Sciences, two Honorable Mention awards were given. First-place award winners received $100 and Honorable mention winners received $50.

Student Presentation Awards

Physical Science – 1st Place Talk

Kimbrie L. Gobbi, Patricia V. Narwold, Sarah C. Gray, University of San Diego, Marine Science and Environmental Studies Department

INORGANIC SEDIMENT SOURCE, FLUX, AND COMPOSITION WITHIN BAYS IN ST. JOHN, U.S. VIRGIN ISLANDS

Molecular Biology and Physiology – 1st Place Talk

Brar NB[1,2], Waggoner CM[1,2], Reyes JA[1,2], Fairey R[3], and Kelley KM.[1,2]
[1]Environmental Endocrinology Laboratory Department of Biology, CSULB, CA 90840.
[2]Institute for Integrated Research on Materials, Environment, and Society, CSULB, CA 90840.
[3]Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories, CA

DOCUMENTATION OF THYROID ENDOCRINE DISRUPTION IN PACIFIC STAGHORN SCULPIN (*LEPTOCOTTUS ARMATUS*) AND SHINER SURFPERCH (*CYMATOGASTER AGGREGATA*) RESIDING IN SAN FRANCISCO BAY

Ecology and Evolution – 1st Place Talk (tied)

A.W. Fredell and D. C. Zacherl, California State University Fullerton, Fullerton, CA, 92834

OUT OF THE SAND AND INTO THE SURF: DETERMINING PHILOPATRY AND POPULATION CONECTIVITY IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS* (ATHERINOPSIDAE).

Danielle Y. Trathen California State University, Los Angeles

COMPARATIVE PHYLOGEOGRAPHY OF CARIBBEAN SEA SLUGS WITH LONG-LIVED VS. SHORT-LIVED LARVAE

Ecology: Honorable mention (2 papers)

Lisa Komoroske[1], Rebecca Lewison[1], Peter H. Dutton[2], Jeffrey Seminoff[2], Dimitri Deheyn;[3]
[1]San Diego State University; [2] NOAA- Southwest Fisheries Science Center;
[3]Scripps Institution of Oceanography

EVALUATING CONTAMINANTS IN AN ENDANGERED SPECIES INHABITING AN URBANIZED COASTAL ECOSYSTEM: *BIOACCUMULATION AND HEALTH EFFECTS IN THE EAST PACIFIC GREEN TURTLE (CHELONIA MYDAS) IN SAN DIEGO BAY*

M.N. Garchow and P. Krug. CSU Los Angeles, Department of Biology, Los Angeles, CA, 90032.

POPULATION DYNAMICS AT A SHIFTING RANGE BOUNDARY BETWEEN SISTER SPECIES OF ESTUARINE SEA SLUG: ROLE OF THE PHYSICAL ENVIRONMENT VERSUS LARVAL SUPPLY

Poster Awardees

Physical Science – 1st Place

REZAIE BOROON, M. H., California State University, Los Angeles, CA, mrezaie@calstatela.edu, **RAMIREZ, P.**, California State University, Los Angeles, CA,

COMBINED GEOCHEMICAL AND DIGENETIC PROCESSES CONTROL THE CADMIUM ENRICHEMENT IN SEDIMENTARY ROCKS OF SOUTHERN TOGO, WEST AFRICA

Molecular Biology and Physiology – 1st Place

Sergio Sandoval, University of La Verne Biology Department, 1950 Third St. La Verne, CA 91750

AN INVESTIGATION OF THE MECHANISM OF METHOXYCHLOR IMPACT ON THE DEVELOPMENT OF THYMOCYTES.

Ecology and Evolution (3 awardees)

T. Duong, J. Gov, and G. Liu. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

AGGREGATING BEHAVIOR AND SPECIES PREFERENCE IN THREE SPECIES OF GUNNEL: *Apodichthys flavidus*, *Apodichthys fucorum* and *Pholis ornate*.

W. Liu, C. Mac, and S. E. Walker. Department of Biological Science, California State University Fullerton, Fullerton CA 92831

THE IMPACT OF FIGHTING STRESS ON LIFESPAN IN THE HOUSE CRICKET (*ACHETA DOMESTICUS*)

N.P. West and K.A. Dickson, California State University Fullerton, Department of Biological Science, Fullerton, CA, 92831.

OCULAR MUSCLES AS A HEAT SOURCE FOR CRANIAL ENDOTHERMY IN THE SHORTFIN MAKO SHARK, *ISURUS OXYRINCHUS*

Student Grants

The Southern California Academy of Sciences supports a program of Grants to graduate and undergraduate students. One stipulation for the winners is that they present their research at the following year's Annual Meeting. This years award winners were

Tracey Magrann Loma Linda University Department of Earth and Biological Sciences

Nutrient Threshold for Production of Cyanobacterial Toxins in Southern California Lagoons, Bays, and Lakes

Thomas Farrugia California State University, Long Beach, Dept of Biology

Biology Department

Site fidelity, residency time and habitat use of the shovelnose guitarfish (*Rhinobatos productus*) in a southern California estuary: assessing restoration success

Chris Chabot University of California, Los Angeles Department of Ecology and Evolutionary Biology

Comparative Phylogeography of the Grey Smoothhound (*Mustelus californicus*) and the Brown Smoothhound (*Mustelus henlei*) from the Northeastern Pacific

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Friday, May 29, 2009
Location: Cecilia 214

Session: Sustainable Fisheries

Chair: Mark Helvey

1 **8:20** **RECONCILING FISHING WITH ENVIRONMENTAL SUSTAINABILITY**
Mark Helvey. NOAA National Marine Fisheries Service, Southwest Region, Sustainable Fisheries Division, Long Beach, CA 90802

2 **8:40** **ASSESSING POST-RELEASE MORTALITY FOR COMMON THRESHER SHARKS CAPTURED IN THE SOUTHERN CALIFORNIA RECREATIONAL FISHERY**
C. Heberer[1]; C.A. Sepulveda[2]; S.A. Aalbers[2]; D. Bernal[3]; S. Kohin[4]; National Marine Fisheries Service, Southwest Region, 6010 Hidden Valley Drive, Carlsbad, CA. 92011 [2]Pfleger Institute of Environmental Research, Oceanside, CA.; [3]University of Massachusetts, Dartmouth, Dartmouth, MA; [4]National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.

3 **9:00** **SEALED OFF FROM THE FISH: EVALUATING A MODIFICATION TO PREVENT MARINE MAMMAL DEPREDATION ON CALIFORNIA HALIBUT TRAWL GEAR**
D. Lawson. National Marine Fisheries Service, Southwest Regional Office, Protected Resources Division, Long Beach, CA, 90803. L. Enriquez and C. Villafana. National Marine Fisheries Service, Southwest Regional Office, Sustainable Fisheries Division, Long Beach, CA, 90803. M. McCorkle and M. Castagnola. Commercial Fisherman, Santa Barbara, CA, 93109.

4 **9:20** **NOAA FISHERIES SERVICE ETHICAL ANGLER PROGRAM**
M.F. Golden. NOAA Fisheries Service, Long Beach, CA 90802

5 **9:40** **FISHES AND FISHING IN THE LOS ANGELES RIVER**
Sabrina L. Drill[1] and Camm Swift[2]. [1]UC Cooperative Extension, Los Angeles County, 4800 E. Cesar Chavez Ave., Los Angeles, CA 90022; [2]Entrix, Inc. 2140 Eastman Ave # 200, Ventura, CA 93003

10:00–10:20 **BREAK**

6 **10:20** **THE NATIONAL MARINE FISHERIES SERVICE SOUTHWEST REGION OBSERVER PROGRAM'S ROLE IN REDUCING BYCATCH AND MANAGING SUSTAINABLE FISHERIES.**
L. Enriquez. National Marine Fisheries Service, Long Beach, CA, 90802. C. Villafana. I.M. Systems Group. Rockville, MD, 20852.

7 **10:40** **FEDERAL STATUTORY FRAMEWORK FOR ACHIEVING ECOSYSTEM SUSTAINABILITY DURING FISHING OPERATIONS IN CALIFORNIA**
Christina C. Fahy National Marine Fisheries Service – Southwest Regional Office; 501 W. Ocean Blvd.; Suite 4200; Long Beach, California 90802

8 **11:00** **CENTRAL COAST GROUNDFISH PROJECT: PARTNERSHIP DRIVEN EFFORT TO IMPROVE CONSERVATION OF GROUNDFISH RESOURCE THROUGH FISHING HARVEST REFORM**
Michael Bell, Project Director, The Nature Conservancy, San Luis Obispo, CA, 93401

11:30–12:30 **Plenary Lecture: Auditorium**
Bill Patzert, Jet Propulsion Laboratory
The Oceans Under Stress...The Future Ain't What It Used to Be.

12:30–1:20 **LUNCH BREAK**

Friday, May 29, 2009
Location: Cecilia 214

Session: Soft Bottom Marine Ecology

Chair: M. James Allen: SCCWRP

9 F 1:40 STUDIES OF TWO INDIGENOUS FLATFISH, PACIFIC SANDDAB AND ENGLISH SOLE, IN SANTA MONICA BAY – SEASONAL AND LOCATION-ASSOCIATED DIFFERENCES IN SEX STEROID LEVELS

D.M. Petschauer, C. Cash, J.A. Reyes and K.M. Kelley Environmental Endocrinology Lab, Marine Biology Program, California State University, Long Beach, Long Beach, CA 90840

10 2:00 BATHYMETRIC RESPONSES IN FUNCTIONAL STRUCTURE OF SOUTHERN CALIFORNIA SOFT-BOTTOM FISH COMMUNITIES TO CHANGING OCEAN CONDITIONS

M. J. Allen, Southern California Coastal Water Research Project, Costa Mesa, CA 92626.

11 2:20 SPAWNING-RELATED MOVEMENTS OF BARRED SAND BASS, *PARALABRAX NEBULIFER*, IN SOUTHERN CALIFORNIA: INTERPRETATIONS FROM TWO DECADES OF HISTORICAL TAG AND RECAPTURE DATA.

E.T. Jarvis, C. Linardich, and C.F. Valle. California Department of Fish and Game, Marine Region, Los Alamitos, CA, 90720.

12 F 2:40 HABITAT USE AND THE EFFECTS OF HABITAT BREAKS ON THE MOVEMENTS OF TEMPERATE GAMEFISHES IN A SOUTHERN CALIFORNIA MARINE PROTECTED AREA

T. Mason and C.G. Lowe. California State University Long Beach, Department of Biological sciences, Long Beach, CA, 90840.

3:00–3:20 BREAK

13 3:20 FIELD RESEARCH AT CABRILLO MARINE AQUARIUM: LONG- TERM MONITORING OF LOCAL MARINE HABITATS

Julianne E. Kalman. Cabrillo Marine Aquarium. 3720 Stephen M. White Drive, San Pedro, CA 90731.

14 3:40 MEGABENTHIC INVERTEBRATES OF THE UPPER CONTINENTAL SLOPE OFF SOUTHERN CALIFORNIA

Don Cadien, Marine Biology Lab, Sanitation Districts of Los Angeles County, Carson, CA, 90745

15 4:00 CAN SEDIMENT PROFILE IMAGING ENHANCE TRADITIONAL BENTHIC ASSESSMENTS?

J. Ananda Ranasinghe[1] and Giancarlo Cicchetti[2]. [1]Southern California Coastal Water Research Project (SCCWRP), Costa Mesa, CA 92626 and [2]US Environmental Protection Agency, Narragansett, RI 02882.

16 4:20 THE SANDY BEACH ECOSYSTEM AS AN INTEGRATED WHOLE: COMPONENTS, CONNECTIONS, AND CONCERNS

K. L. Martin and J. E. Dugan. Pepperdine University, Department of Biology, Malibu, CA, 90253 and University of California, Santa Barbara, Marine Science Institute, Santa Barbara, CA, 93106.

5:00–7:00 Poster Session

Friday, May 29, 2009
Location: Cecilia 216

Session: Contributed Papers

Chair: John Dorsey, Loyola Marymount University

17 8:00 **INDICATION OF PROTEIN PRESERVATION IN THE FOSSIL WHALE BONES OF THE MIOCENE/PLIOCENE PISCO FORMATION, PERU**
U.L. Vidal[1], D.S. Boskovic[1,2], L.R. Brand[1]. [1]Department of Earth and Biological Sciences, School of Science and Technology, Loma Linda University, Loma Linda, CA, 92350. [2]Division of Biochemistry, School of Medicine, Loma Linda University, Loma Linda, CA, 92350.

18 E 8:20 **SLUG SEX, REPRODUCTIVE INTERFERENCE, AND ALLEE EFFECTS AT A SHIFTING RANGE BOUNDARY**
A.S. Llaban and P.J. Krug. California State University Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032.

19 E 8:40 **THE ENDANGERED MORRO BAY KANGAROO RAT *DIPODOMYS HEERMANNI MORROENSIS* IN SAN LUIS OBISPO COUNTY, CALIFORNIA: 2008.**
C.P. Kofron and F.X. Villablanca. U.S. Fish and Wildlife Service, Ventura, CA; and Department of Biological Sciences, California Polytechnic State University, San Luis Obispo.

20 9:00 **FROM DOT LOCALITIES TO AN UPDATED DISTRIBUTION MAP: REFINING THE DISTRIBUTION PATTERN OF THE RARE "COMMON GARTERSNAKE" (THAMNOPHIS SIRTALIS) IN THE SEMI-ARID SOUTH COAST BIOREGION OF CALIFORNIA.**
Edward L. Ervin1 and Clark R. Mahrdt2. 1Associate Biologist, Merkel & Associates, Inc., 5434 Ruffin Road, San Diego, CA 92123; 2Research Assistant, San Diego Natural History Museum, Dept. of Herpetology, P.O. Box 121390, San Diego, CA 92112-1390

21 E 9:20 **FLUCTUATING AND TRANSLATIONAL ASYMMETRY AS INDICATORS OF STRESS FOR COASTAL WETLAND PLANTS**
LaRie Burgoyne, Daryle Hinton-Hardin, Gianna Ramos, Mackenzie Shribbs, and Dr. Philippa M. Drennan, Loyola Marymount University, Department of Biology, Los Angeles, CA 90045

22 E 9:40 **EVALUATING CONTAMINANTS IN AN ENDANGERED SPECIES INHABITING AN URBANIZED COASTAL ECOSYSTEM: *BIOACCUMULATION AND HEALTH EFFECTS IN THE EAST PACIFIC GREEN TURTLE (CHELONIA MYDAS) IN SAN DIEGO BAY***
Lisa Komoroske[1], Rebecca Lewison[1], Peter H. Dutton[2], Jeffrey Seminoff[2], Dimitri Deheyn[3]; [1]San Diego State University; [2]NOAA- Southwest Fisheries Science Center ; [3]Scripps Institution of Oceanography

10:00–10:20 **BREAK**

Friday, May 29, 2009
Location: Cecilia 216

Session: Climate Change

Chair: Ann Dalkey, Palos Verdes Peninsula Land Conservancy

23 10:20 **EVERYONE CAN MAKE A DIFFERENCE: REDUCING GREENHOUSE GAS EMISSIONS AT THE LOCAL LEVEL.**
Dalkey, A. Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274

24 10:40 **THE IMPACT OF GLOBAL CLIMATE CHANGE ON SOUTHERN CALIFORNIA: IMPLICATIONS ON WATER RESOURCES, WILDFIRES, AND AIR QUALITY**
Kim, Jinwon, Joint Institute For Regional Earth System Science and Engineering/Department of Atmospheric and Oceanic Sciences, University of California Los Angeles

25 11:00 **CLIMATE CHANGE IMPACTS ON WATER RESOURCES IN SOUTHERN CALIFORNIA**
Jeremy S. Pal, Loyola Marymount University, Seaver College of Science and Engineering, Department of Civil Engineering and Environmental Science, Los Angeles, CA 90045.

11:30–12:30 Plenary Lecture: Location: Auditorium
Bill Patzert, Jet Propulsion Laboratory
The Oceans Under Stress...The Future Ain't What It Used to Be.
12:30–1:20 LUNCH BREAK

Friday, May 29, 2009
Location: Cecilia 216

Session: Contributed Papers

Chair: Brad Blood, PSOMAS

26 1:20 **STATUS, DISTRIBUTION, AND RELATIVE ABUNDANCE OF FISHES IN THE UPPER SAN GABRIEL RIVER BASIN.**
J. W. O'Brien, H. K. Hansen, and M. E. Stephens. California Department of Fish and Game, 4665 Lampson Ave, Suite C, Los Alamitos, CA, 90720.

27 E 1:40 **BIRD USE OF CONCRETE-BOTTOM AND NATURAL-BOTTOM HABITATS ON THE LOS ANGELES RIVER**
R. Uyehara, **C. Kumpu**, and J. R. Thomlinson. Department of Biology, California State University Dominguez Hills, Carson, CA 90747.

28 2:00 **BLACK FLY (DIPTERA: SIMULIIDAE) DISTRIBUTION, DIVERSITY, AND ANTHROPOGENIC INFLUENCES ON LARVAL ABUNDANCE IN THE UPPER SAN GABRIEL RIVER CATCHMENT (LOS ANGELES COUNTY, CALIFORNIA).**
C.W. Solek, Southern California Coastal Water Research Project, Watersheds Department, Costa Mesa, CA, 92626.

29 E 2:20 **SETTLEMENT OF *OSTREA LURIDA* AS A FUNCTION OF TIDAL HEIGHT IN NEWPORT BAY, CALIFORNIA**
L.A. Sam and D.C. Zacherl. California State University, Fullerton. Department of Biological Science.

30 E 2:40 **ALGAL CONTROL BY PHOSPHATE RESTRICTION IN SHALLOW, FRESHWATER LAKES**
T. M. Magrann, S. G. Dunbar, PhD, and D. Boskovic, PhD.Marine Research Group, Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

3:00–3:20 **BREAK**

31 E 3:20 **THE PHYTOREMEDIATION CAPACITY OF BACCHARIS SALICIFOLIA WITH RESPECT TO COPPER SEQUESTRATION**
Cordale Johnson, John Thomlinson, and Connie Vadheim Roth, Cal State University Dominguez Hills, Department of Biology, Carson, CA, 90747

32 E 3:40 **THE PRODUCTION OF ACOUSTIC SIGNALS IN THE HOUSE CRICKET ACHETA DOMESTICUS: MORPHOLOGICAL INFLUENCE ON CALLING SONGS.**
D. Lim and S.E. Walker. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92831.

33 E 4:00 **EFFECT OF EXOTIC ANNUAL GRASS REMOVAL ON THE RE-ESTABLISHMENT OF COMMON NATIVE OAK UNDERSTORY SPECIES ON SANTA CATALINA ISLAND, CA**
Matthew P. Sutton and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

34 E 4:20 **ARE ALL LARVAE CREATED EQUAL? LIPID VARIATION IN *KELLETIA KELLETII* LARVAE ACROSS THEIR GEOGRAPHIC RANGE.**
S.L. Kelley and D.C. Zacherl. Southern California Ecosystems Research Program, California State University, Fullerton, Department of Biology, Fullerton, CA, 92831.

35 E 4:40 **OUT OF THE SAND AND INTO THE SURF: DETERMINING PHILOPATRY AND POPULATION CONECTIVITY IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS* (ATHERINOPSIDAE).**
A.W. Fredell and D. C. Zacherl, California State University Fullerton, Fullerton, CA, 92834

5:00–7:00 **Poster Session**

Friday, May 29, 2009
Location: View Room

Session: Poster Session and Wine and Cheese Social 5–7 P.M.

36 **COMPARISON OF TWO URBAN WETLAND SITES USING BENTHIC MACROINVERTEBRATES AND ABIOTIC VARIABLES**
D. A. Anaya and John R. Thomlinson, California State University, Dominguez Hills, Department of Biology, Carson, CA, 90747

37 E **THE EFFECTS OF LIGHT AND FEEDING CYCLES ON FEEDING ANTICIPATORY BEHAVIORS OF THE BAY PIPEFISH, *SYNGNATHUS LEPTORHYNCHUS***
K. Bayley, H. Chu and M. Estrada. University of California Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90024

38 E **CORRELATION BETWEEN FREQUENCY OF MARINE LEECH (*Malmiana buthi*) INFECTION AND THE SIZE OF ITS FISH HOST (*Oligocottus snyderi*)**
Noelle Bidegainberry, Alison Fujii, and Larisa Pender-Healy, Dept. of Ecology and Evolutionary Biology, UCLA

39 P **COMBINED GEOCHEMICAL AND DIGENETIC PROCESSES CONTROL THE CADMIUM ENRICHEMENT IN SEDIMENTARY ROCKS OF SOUTHERN TOGO, WEST AFRICA**
M.H. REZAIE-BOROON, California State University, Los Angeles, CA, mrezaie@calstatela.edu, **RAMIREZ, P.**, California State University, Los Angeles, CA, pramir@calstatela.edu, **GNANDI, K.**, University of Lome, Togo, kgnandi@yahoo.fr

40 F **DEVELOPMENT OF THE HEART AND QUANTIFICATION OF SPONGY VERSUS COMPACT MYOCARDIUM IN ENDOTHERMIC AND ECTOTHERMIC SCOMBRID FISHES**
Doreen Emilee Carpio, Lori Critchfield, and Kathryn Dickson; California State University of Fullerton, Department of Biological Science; Fullerton, CA 92831

41 E **INTROGRESSION OF MITOCHONDRIAL DNA BETWEEN CATOSTOMUS FUMEIVENTRIS AND CATOSTOMUS SANTAANAE (CYPRINIFORMES: CATOSTOMIDAE) IN THE SANTA CLARA DRAINAGE**
Chris Chabot[1], Donald Buth[1], Camm Swift[2], Jonathan Sim[1], Thomas Dowling[3], Larry Allen[4;1]UCLA, Los Angeles, CA, [2]Entrix, Inc., Ventura, CA, [3]Arizona State University, Tempe, AZ, [4]California State University, Northridge, CA

42 **A COMPARISON OF CURRENT AND HISTORICAL SHOREBIRD POPULATIONS IN VENTURA COUNTY: PRELIMINARY RESULTS**
Angela Chapman, Donald A. Rodriguez, Christopher Kahler, Christina Fahim, Lisa Winfrey and Amanda Goldstein. Biology and Environmental Science and Resource Management Programs, One University Drive, California State University Channel Islands, Camarillo, CA 93012

43 **A STING TO DIE FOR: RELATIONSHIP BETWEEN VENOM AVAILABILITY AND PREDATORY AND DEFENSIVE STINGING BEHAVIOR IN THE CENTIPEDES *SCOLOPENDRA POLYMORPHA* AND *S. SUBSPINIPES***

A.M. Cooper, G.A. Fox, D.R. Nelsen, and W.K. Hayes. Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

44 E **HOW DANGEROUS ARE BABY RATTLESNAKES? ORIGIN AND PREVALENCE OF A DEFANGED MYTH**

A.G. Corbit and W.K. Hayes, Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA, 92350

45 E **STORMWATER PLUME DEVELOPMENT IN SANTA MONICA BAY, CA (USA)**

A.A. Corcoran, K.M. Reifel, B.H. Jones and R.F. Shipe. Department of Ecology and Evolutionary Biology, University of California Los Angeles, Los Angeles, CA 90095; Marine Environmental Biology, Department of Biological Sciences, University of Southern California, Los Angeles, CA 90089; Institute of the Environment, University of California Los Angeles, Los Angeles, CA 90095.

46 **MICROCLIMATE TRENDS FOR THREE SPECIES OF COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA.**

Dalkey[1], A., N. Lim[2], O. Saliu[2], and N. Wakama[2]. Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274; [2]Palos Verdes Peninsula High School, Rolling Hills Estates, CA 90274.

47 E **AGGREGATING BEHAVIOR AND SPECIES PREFERENCE IN THREE SPECIES OF GUNNEL: *Apodichthys flavidus*, *Apodichthys fucorum* and *Pholis ornate*.**

T. Duong, J. Gov, and G. Liu. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

48 F **COMPARISON OF DIGESTIVE ENZYME ACTIVITIES IN THE ENDOTHERMIC MAKO SHARK AND THE ECTOTHERMIC BLUE SHARK**

Ali Forghani, Ramtin Khanipour, and Kathryn Dickson; California State University of Fullerton, Department of Biological Science; Fullerton, CA 92831

49 **VENOM YIELD AND CHARACTERISTICS IN THE DESERT HAIRY SCORPION (HADRURUS ARIZONENSIS)**

G.A. Fox, W.K. Hayes, A.M. Cooper, and D.R. Nelsen. Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA, 92350.

50 **TEMPORAL TRENDS IN SOUTHERN CALIFORNIA SURF FISH POPULATIONS**

H.L. Gliniak, C.F. Valle, E.T. Jarvis, O. Horning, and C. Linardich. California Department of Fish and Game, Los Alamitos, CA 90720.

51 **TOLERANCE INTERVALS OF BIOINDICATORS CHARACTERIZE REFERENCE CONDITIONS FOR SOFT BOTTOM MACROFAUNA OFF SAN DIEGO, SOUTHERN CALIFORNIA**

Nick Haring, Tim Stebbins, Ron Velarde; City of San Diego Marine Biology Laboratory, Metropolitan Wastewater Department, San Diego, CA 92101

52 **SPATIAL AND TEMPORAL ANALYSIS OF BARRED SAND BASS CATCH IN THE SOUTHERN CALIFORNIA PRIVATE/RENTAL BOAT FISHERY (2004–2008)**

O. Horning, E.T. Jarvis, and C.F. Valle. California Department of Fish and Game, Marine Region, Los Alamitos, CA, 90720.

53 E **DISTRIBUTION AND ABUNDANCE OF JUVENILE *POCILLOPORA SP.* AND ENCRUSTING CORALLINE ALGAE ON OCEANOGRAPHIC MOORINGS AROUND MOOREA, FRENCH POLYNESIA**

A.K. James. Moorea LTER, University of California Santa Barbara, Department of Ecology Evolution and Marine Biology, Santa Barbara, CA, 93117.

54 **TO SPECIATE OR NOT TO SPECIATE?: POPULATION STRUCTURE OF *HAMINOEA VESICULA* (OPISTHOBRANCHIA: HAMINOEIDAE) IN THE NORTHEAST PACIFIC**

Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789.Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032

55 E **THE IMPACT OF FIGHTING STRESS ON LIFESPAN IN THE HOUSE CRICKET (*ACHETA DOMESTICUS)***

W. Liu, C. Mac, and S. E. Walker. Department of Biological Science, California State University Fullerton, Fullerton CA 92831

56 E **DO WOODY CHAPARRAL SPECIES FACILITATE RECRUITMENT OF ISLAND OAKS ON CATALINA ISLAND?**

Miguel A. Macias, Matthew P. Sutton and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

57 **ENVIRONMENTAL METAPHORS IN SCIENCE AND SOCIETY: WORKFLOW OF THE CASE STUDY "THE ELEPHANT AND THE OAK TREE"**

V.G. Minnich. University of California, Santa Barbara. Donald Bren School of Environmental Science and Management. Santa Barbara, CA, 93106.

58 M **POSSIBLE ROLE OF KIDNEY CHROMAFFIN CELLS IN CRANIAL ENDOTHERMY IN THE ALBACORE TUNA, *Thunnus alalunga***

H. Musharbash and K.A. Dickson, Department of Biological Science, California State University, Fullerton, Fullerton, CA, 93831

59 **POKE BUT DON'T PINCH: RISK ASSESSMENT AND DEFENSIVE BEHAVIORS OF THE WESTERN WIDOW SPIDER (*LATRODECUTS HESPERUS*)**

D.R. Nelsen, A.M. Cooper, G.A. Fox, and W.K. Hayes. Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

60 E **ECOLOGY OF AN INTERTIDAL LEECH: EXPANDING THE RANGE OF *MALMIANA BUTHI***

J.C. Notar and J. Gessow. University of California, Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

61 **AERIAL THERMAL IMAGERY AND PLANT DIVERSITY IN POST-FIRE ENVIRONMENTS OF THE NORTH MOUNTAIN EXPERIMENTAL AREA**

Mark E. Parlow, Marcia G. Narog, Jan L. Beyers, David R. Weise, Philip J. Riggan, and Anna Wrona, USDA Forest Service, Riverside, California, 92507

62 F **THE USE OF ROTENONE AS MEANS OF INCREASING SURVEY BIODIVERSITY IN THE ROCKY INTERTIDAL ZONE**

C.R. Pospisil, Rene Carbajal and Suong Tran. Department of Ecology and Evolutionary Biology, UCLA, Los Angeles CA, 90095-1606

63 E **AN HERBARIUM STUDY OF THE PHENOLOGY OF FOUR WET-SEASON DECIDUOUS TROPICAL PLANT SPECIES**

J. Quintanilla, L. Gabrielian, and V. Carmona-Galindo. Department of Biology, Loyola Marymount University, Los Angeles, CA 90045.

64 E **DO *Medicago truncatula* SEEDS PERCEIVE NOD FACTOR?**

N.R. Rahman, G.Ramírez, and G. Brelles-Mariño, California State Polytechnic University, Biological Sciences Department, 3801 W. Temple Ave., Pomona, CA 91768.

65 **EVIDENCE FOR SIMILAR CLIMATIC CONDITIONS DURING DEPOSITION OF THE PALEOCENE SILVERADO AND LAS VIRGENES FORMATIONS OF SOUTHERN CALIFORNIA AND THE EOCENE IONE FORMATION OF CENTRAL CALIFORNIA**

P.C. Ramirez and A.C. Hamane, Department of Geological Sciences, California State University, Los Angeles Los Angeles, CA 90032

66 M **AN INVESTIGATION OF THE MECHANISM OF METHOXYCHLOR IMPACT ON THE DEVELOPMENT OF THYMOCYTES.**

Sergio Sandoval, University of La Verne Biology Department, 1950 Third St. La Verne, CA 91750

67 E **DISTRIBUTION OF MYLITUS AND PISASTER AT THE LOS ANGELES R IVER OUTLET**

S.R. Scoma, L.C. Teague, A.M. Noice, M. Moradian. Pasadena City College, Pasadena, 91101.

68 F **EFFECTS OF DELAYED HATCHING ON DEVELOPMENT AND SWIMMING SPEED IN THE CALIFORNIA GRUNION, LEURESTHES TENUIS**

Treybig, Tracie; Degrassi, Allyson; Casillas, Ernesto; Hessom, Elizabeth; Ramos, Elaine.

69 E **THE DISTRIBUTION AND BEHAVIOR OF THE INTERTIDAL LEECH *Malmiana buthi* AS OBSERVED IN THE ROCKFISH TANK AT THE BODEGA MARINE LABORATORY**
Ashleigh Berger, David Lau, **Christina Truong**. Department of Ecology and Evolutionary Biology, University of California, Los Angeles, 90024

70 E **TEMPERATURE REQUIREMENTS FOR GERMINATION OF THE SAND VERBENAS *ABRONIA MARITIMA* S. AND *ABRONIA UMBELLATA* Lam.**
Kristine Tulio and Philippa M Drennan, Loyola Marymount University, Department of Biology, Los Angeles, CA 90045

71 P **IDENTIFYING CULTURABLE BACTERIA FROM DEL REY LAGOON, LOS ANGELES COUNTY, DURING FLOOD AND EBB TIDAL FLOWS**
Jennifer T. Valdez[1], Julie Huh[2], John H. Dorsey[3], Loyola Marymount University, Department of Civil Engineering , Los Angeles, CA 90045[1], Marlborough School, Los Angeles, CA 90004[2], Loyola Marymount University, Natural Science Department, Los Angeles, CA 90045[3]

72 E **SEXUAL DIMORPHISM IN HOUSE CRICKETS (*ACHETA DOMESTICUS*) AND *GRYLLUS PENNSYLVANICUS***
B.D. Narcisse[1], **K. Vuong**[1], J. Andrew Roberts[2], and S. E. Walker[1]. [1]Department of Biological Science, California State University Fullerton, Department of Biology, Fullerton, CA, 92831.[2]Department of Evolution, Ecology, and Organismal Biology, The Ohio State University at Newark, Newark OH, 43055

73 M **THE EFFECTS OF AGE AND STRESS ON THE IMMUNE RESPONSE OF MALE AND FEMALE HOUSE CRICKETS (*ACHETA DOMESTICUS*)**
K. Celeste, E. Hill, and **S. E. Walker** Department of Biological Science, California State University Fullerton, Fullerton, CA, 92831.

74 E **OCULAR MUSCLES AS A HEAT SOURCE FOR CRANIAL ENDOTHERMY IN THE SHORTFIN MAKO SHARK, *ISURUS OXYRINCHUS***
N.P. West and K.A. Dickson, California State University Fullerton, Department of Biological Science, Fullerton, CA, 92831.

75 **EFFECTS OF RECENT FIRE ON PLANT DIVERSITY ALONG CHAPARRAL FUEL BREAKS**
Anna M. Wrona, Marcia G. Narog, Tim Paysen, Jan L. Beyers, USDA Forest Service Pacific Southwest Research Station, Riverside, California, 92507.

Saturday, May 30, 2009
Location: Cecilia 214

Session: Reef Biology

Chair: Daniel Pondella III, Occidental College

76 P 8:40 **INORGANIC SEDIMENT SOURCE, FLUX, AND COMPOSITION WITHIN BAYS IN ST. JOHN, U.S. VIRGIN ISLANDS**
Kimbrie L. Gobbi, Sarah C. Gray, Patricia V. Narwold, University of San Diego, Marine Science and Environmental Studies Department, 5998 Alcala Park, San Diego, CA 92110

77 F 9:00 **EVIDENCE OF REDUCED GENE FLOW ALONG AN INSHORE- OFFSHORE GRADIENT OBSERVED IN KELP BASS (*PARALABRAX CLATHRATUS*) IN THE SOUTHERN CALIFORNIA BIGHT**
S.M. Trbovich and R.R. Wilson, Jr. California State University-Long Beach, Department of Biological Sciences, Long Beach, CA 90840

78 9:20 **BOOM AND BUST IN SOUTHERN CALIFORNIA KELP BEDS**
Michael D. Curtis Senior Scientist MBC Applied Environmental Sciences Costa Mesa, CA

79 E 9:40 **A TEST FOR CORRELATED RECRUITMENT OF PREDATOR AND PREY SPECIES OF KELP FOREST FISHES**
J.M. Krug and M.A. Steele. California State University, Northridge, Department of Biology, Northridge, CA, 91330.

10:00–10:20 **BREAK**

80 10:20 **BOTTOM-UP FORCING AND VARIATION IN THE SOUTHERN CALIFORNIA GIANT KELP FORESTS, 1967–2007.**
Eric F. Miller, MBC Applied Environmental Sciences, Costa Mesa, CA

81 10:40 **THE ROCKY REEFS OF THE SOUTHERN CALIFORNIA BIGHT**
D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041

82 11:00 **THE ICHTHYOPLANKTON OF KING HARBOR, REDONDO BEACH, CALIFORNIA, 1974–2006**
D. J. Pondella, II[1]. J. P. Williams[1] and E. F. Miller[2] [1]Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041. [2]MBC Applied Environmental Sciences, 3000 Red Hill Ave., Costa Mesa, CA 92626

11:30–12:30 **Plenary Lecture: Location: Auditorium**
Dr. Ann Scarborough Bull, Minerals Management Service
Outlook On The Outer Continental Shelf For Offshore Energy

12:30–1:20 **LUNCH BREAK**

Saturday, May 30, 2009
Location: Cecilia 214

Session: Marine Platforms

Chair: Chris Lowe, CSU Long Beach

83 1:40 **15 YEARS OF PLATFORM FISH RESEARCH SOMEHOW REDUCED TO A 15 MINUTE SOUNDBITE**
M. S. Love and M. Nishimoto, Marine Science Institute, University of California, Santa Barbara, 93106. D. S. Schroeder, Minerals Management Service, 770 Paseo Camarillo, CA 93010.

84 2:00 **HABITAT FORMING INVERTEBRATES ASSOCIATED WITH OIL PLATFORMS IN THE SANTA BARBARA CHANNEL: POSSIBLE ALTERNATIVE STABLE STATES**
H.M. Page, J.E. Dugan, C.S. Culver, and S.C. Schroeter, Marine Science Institute, University of California, Santa Barbara, CA, 93117.

85 2:20 **SITE FIDELITY PATTERNS OF GROUNDFISHES ASSOCIATED WITH PLATFORMS IN THE SANTA BARBARA CHANNEL.**
C.G. Lowe[1], K.M Anthony[1], E.T. Jarvis[1], L.F. Bellquist[1], and M.S. Love[2]. [1]California State University Long Beach, Dept. of Biological Sciences, Long Beach, CA 90840, [2]Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA 93106

86 F 2:40 **HOMING AND HABITAT USE OF ROCKFISHES AROUND OIL PLATFORMS IN THE SANTA BARBARA CHANNEL.**
K.M. Anthony and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA, 90840.

3:00–3:20 **BREAK**

87 3:20 **FISH RECRUITMENT AT PLATFORMS IS LINKED TO OCEAN CURRENT PATTERNS**
M.M. Nishimoto[1], L. Washburn[2, 3], M.S. Love[1], D.M. Schroeder[4] and B.M. Emery[3]. [1]Marine Science Institute, University of California, Santa Barbara, CA 93117; [2]Department of Geography, UCSB; [3]Institute for Computational Earth System Science, UCSB; [4]Minerals Management Service, Pacific OCS Region, Camarillo, CA

88 3:40 **SAN PEDRO SHELF PLATFORM FISH ASSEMBLAGES AND RELATIONS TO HABITAT QUALITY**
C.J.B. Martin*, B.J. Allen, and C.G. Lowe. Department of Biological Sciences, California State University, Long Beach, CA 90840

89 F 4:00 **THE SITE FIDELITY AND DEPTH DISTRIBUTION OF SHALLOW OCCURRING NEARSHORE REEF SPECIES INHABITING OFFSHORE PETROLEUM PLATFORMS ON THE SAN PEDRO SHELF**
Carlos Mireles and Christopher G. Lowe, Department of Biology, California State University Long Beach, 1250 Bellflower Blvd, CA, 90840

90 4:20 **WHAT CAN OIL PLATFORM STUDIES TELL US ABOUT THE POTENTIAL ECOLOGICAL CONSEQUENCES OF OFFSHORE RENEWABLE ENERGY?**
D. M. Schroeder and A. Scarborough-Bull. Minerals Management Service, 770 Paseo Camarillo, Camarillo, CA, 93010.

Saturday, May 30, 2009
Location: Cecilia 203

Session: Archaeology

Chair: Edgar Huerta and Steven James, CSU Fullerton

91 1:40 **RETHINKING THE PARADIGM: THE CLAY ARTIFACTS FROM CA-ORA-64, THEIR SIGNIFICANCE, AND PLACE WITHIN THE EARLY CERAMIC COMPLEX OF SOUTHERN CALIFORNIA AND ADJACENT REGIONS.**
Edgar Huerta. Department of Anthropology, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA 92831.

92 2:00 **ZOOARCHAEOLOGICAL EVIDENCE FOR A TRANS-HOLOCENE "BROAD-SPECTRUM REVOLUTION" ON THE CALIFORNIA COAST.**
Judith F. Porcasi, Cotsen Institute of Archaeology at UCLA, Los Angeles, CA, 90095

93 2:20 **SAN CLEMENTE ISLAND STEATITE SOURCING**
Amy L. Tupa. California State University Long Beach, Department of Anthropology, Long Beach, CA 90840

94 2:40 **THE NINTH CHANNEL ISLAND: ARCHAEOLOGICAL INVESTIGATIONS AT ABALONE COVE ON THE PALOS VERDES PENINSULA.**
Steven R. James and Gary Jones. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

3:00–3:20 **BREAK**

Saturday, May 30, 2009
Location: Cecilia 203

Session: Paleontology

Chair: Mark Roeder, San Diego Natural History Museum

95 3:20 **MARINE DINOFLAGELLATES FROM THE OLIGOCENE OTAY FORMATION, SAN DIEGO COUNTY, SOUTHERN CALIFORNIA**
L.H. Fisk, PaleoResource Consultants, 550 High Street, Suite #108, Auburn, CA, 95603, J. Lucas-Clark, Clark Geological, Inc., Fremont, CA 94536, and L.R. Pratt, PaleoResource Consultants, Auburn, CA, 95603.

96 3:40 **STRATIGRAPHIC LEAKAGE OF TERTIARY PALYNOMORPHS INTO BEDFORD CANYON FORMATION LIMESTONE, SANTA ANA MOUNTAINS, SOUTHERN CALIFORNIA**
L.H. Fisk, PaleoResource Consultants, 550 High Street, Suite #108, Auburn, CA, 95603, G.J. Jaecks, American River College, Sacramento, CA 95841, D.M. Haasl, PaleoResource Consultants, Auburn, CA, 95603, D.F. Maloney, PaleoResource Consultants, Auburn, CA, 95603, and M.R. Roeder, Paleo Environmental Associates, Inc., Costa Mesa, CA, 92626.

97 4:00 **NEOGENE HERPETOFAUNAS FROM LOUISIANA, USA AND THEIR BIOGEOGRAPHICAL AND PALEOENVIRONMENTAL SIGNIFICANCE**
M. J. Williams Natural History Museum of Los Angeles County, Department of Vertebrate Paleontology, Los Angeles, Ca 90007

98 4:20 **LATE PLEISTOCENE FOSSILS FROM THE PACIFIC CITY PROJECT SITE IN HUNTINGTON BEACH, SOUTHERN CALIFORNIA**
M.A. Roeder, Department of Paleontology, San Diego Natural History Museum P.O. Box 121390, San Diego, CA 92112.

Saturday, May 30, 2009
Location: Cecilia 216

Session: Contributed Papers

Chair: John Roberts, California State University, Dominguez Hills

99 E 1:20 **POPULATION DYNAMICS AT A SHIFTING RANGE BOUNDARY BETWEEN SISTER SPECIES OF ESTUARINE SEA SLUG: ROLE OF THE PHYSICAL ENVIRONMENT VERSUS LARVAL SUPPLY**
M.N. Garchow and P. Krug. CSU Los Angeles, Department of Biology, Los Angeles, CA, 90032.

100 E 1:40 **NITRIC OXIDE SIGNALING REGULATES LARVAL METAMORPHISIS IN A HOST-SPECIALIZED SEA SLUG.**
M. R. Romero and P. J. Krug, California State University, Los Angeles, Department of Biology, Los Angeles, CA 90032.

101 E 2:00 **COMPARATIVE PHYLOGEOGRAPHY OF CARIBBEAN SEA SLUGS WITH LONG-LIVED VS. SHORT-LIVED LARVAE**
Danielle Y. Trathen California State University, Los Angeles

102 E 2:20 **STABLE ISOTOPE ANALYSIS OF A SEAGRASS FOOD WEB IN SAN DIEGO BAY**
J.P. Farlin, Fish Ecology Laboratory, San Diego State University, San Diego, CA, 92115.

103 M 2:40 **DOCUMENTATION OF THYROID ENDOCRINE DISRUPTION IN PACIFIC STAGHORN SCULPIN (*LEPTOCOTTUS ARMATUS*) AND SHINER SURFPERCH (*CYMATOGASTER AGGREGATA*) RESIDING IN SAN FRANCISCO BAY**
Brar NB[1,2], Waggoner CM[1,2], Reyes JA[1,2], Fairey R[3], and Kelley KM.[1,2] [1]Environmental Endocrinology Laboratory Department of Biology, CSULB, CA 90840. [2]Institute for Integrated Research on Materials, Environment, and Society, CSULB, CA 90840. [3]Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories, CA

3:00–3:20 **BREAK**

104 F 3:20 **FACTORS THAT ELICIT A SWITCH IN LARVAL DEVELOPMENT OF THE SEA SLUG ALDERIA WILLOWI**
Dominique Gordon and Patrick Krug . Biological Sciences, California State University, Los Angeles

105 3:40 **SURVIVAL AT THE EDGE: ECOPHYSIOLOGY AND RANGE LIMITS OF *ALDERIA***
E.L. Shimer and P.J. Krug, California State University, Los Angeles, Department of Biology, Los Angeles, CA 90032

106 4:00 **POSSIBLE MACROBENTHIC COMMUNITIES IN THE DEEPEST OCEAN HADAL TRENCHES**
Kent D. Trego, Nautilus Oceanic Institute, La Jolla, California 92037

107 4:20 **INTERNAL OCEAN SURFACING ON THE JUPITER SATELLITES EUROPA AND GANYMEDE**
K.D. Trego, Nautilus Oceanic Institute, La Jolla, CA 92037

108 4:40 **EVAPORATION OF OCEANS ON THE SURFACE OF MARS**
Kent D. Trego, Nautilus Oceanic Institute, La Jolla, CA 92037

Saturday, May 30, 2009
Location: Cecilia 202

Session: Research Training Program Session I

Chair: Richard Schwartz

109 8:20 **COMPARATIVE HISTOLOGY OF THE DIGESTIVE TRACT IN THE SOUTH AMERICAN PARASITIC CATFISHES (TELEOSTEI, TRICHOMYCTERIDAE)**
Diep, Brian[1], Jonathan N. Baskin[2], Andrew Chen[2] San Gabriel High School, San Gabriel, CA, 91776[1], California State Polytechnic University Pomona, Department of Biological Sciences, Pomona, CA, 91768[2]

110 8:40 **CRYPTIC SPECIES AND SYNONYMS: A RECLASSIFICATION OF THE TROPICAL SPURILLA GENUS**
Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

111 9:00 **AN ANALYSIS OF COYOTE AND FOX DIETARY HABITS IN THE PALOS VERDES LAND PRESERVES, PALOS VERDES PENINSULA, LOS ANGELES COUNTY, CALIFORNIA**
Mitchell, Alayna[1]; Dalkey, Ann[2] Torrance High School, 2200 West Carson Street, Torrance, CA 90501[1] Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Suite 207, Rolling Hills Estates, CA 90274[2]

112 9:20 **ANTS AS SYMBIOTIC PARTNERS AND HABITAT QUALITY INDICATORS FOR *GLAUCOPSYCHE LYGDAMUS PALOSVERDESENSIS*, THE PALOS VERDES BLUE BUTTERFLY**
Ariel Takayanagi; Palos Verdes High School

113 9:40 **DYNAMICS OF FECAL INDICATOR AND OTHER BACTERIA DURING VARYING TIDAL CONDITIONS IN DEL REY LAGOON, PLAYA DEL REY, CALIFORNIA**
J.J. Huh, J.T. Valdez, J. Dorsey. Leonetti-O'Connell Honors Research in Science, Loyola Marymount University and Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90015 and 90004.

10:00–10:20 **BREAK**

114 10:20 **AN INVESTIGATION OF RADIOISOTOPES AND E.COLI LEVELS IN SANTA MONICA BEACH**
A. R. Kelleghan Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA

115 10:40 **THE EFFECT OF DENITRIFICATION ON METHANOGENESIS IN CONSTRUCTED WETLANDS**
Sumit Mitra, University High School, Irvine, CA

116 11:00 **EFFECTS OF DROUGHT CONDITIONSON THE WATER RELATION AND PHOTOSYNTHETIC CO_2 UPTAKE OF INVASIVE AND NATIVE PLANTS OF CALIFORNIA**
Suh Y. Woo Teacher Peter Starodub, Mentor Dr. Rasoul Sharifi, Research conducted at University of California, Los Angeles, Department of Ecology and Evolutionary Biology

11:30–12:30 Plenary Lecture: Auditorium
Dr. Ann Scarborough Bull, Minerals Management Service
Outlook On The Outer Continental Shelf For Offshore Energy

12:30–1:20 LUNCH BREAK

Saturday, May 30, 2009
Location: Cecilia 202

Session: Research Training Program Session II

Chair: Martha Schwartz

117 1:40 **MPP+ MEDIATES CALPAIN ACTIVATION IN PRIMARY NEURONS: A FLUORESCENT BASED ANALYSIS OF A PARKINSONIAN MODEL**
Alexa Aranjo, Mr. Martin Byhower, Chadwick School; Professor Michel Baudry University of Southern California

118 2:00 **CONSTRUCTION OF HUMAN RECOMBINANT IgA1 SPECIFIC TO M1 MANNAN ON *CANDIDA ALBICANS* CELL SURFACE**
Elizabeth Hong, Nicole Johnson, and Mason Zhang Ph.D. California State University Long Beach 1250 Bellflower Blvd, MICR 202E Long Beach, CA 92648

119 2:20 **EXTRACELLULAR WNT/β-CATENIN AUTOCRINE SIGNALING SUPPORTS A MALIGNANT PHENOTYPE EVEN WITHOUT INTRACELLULAR WNT PATHWAY MUTATION IN COLON CANCER**
Andrius Planutis *University High School, Irvine, California, and University of California, Irvine, 3800 Parkview Lane #8B, Irvine, California 92612, pandryus@gmail.com*

120 2:40 **EFFECTS OF ALCOHOL CONSUMPTION ON LEFT VENTRICULAR FUNCTION AND CALCIFICATION**
Wu, Helena (Hao); Teacher Peter Starodub, Mentor Dr. Budoff and Dr. Mao, Research conducted at Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center

3:00–3:20 BREAK

121 3:20 **IMPROVING ELEVATOR SCHEDULING EFFICIENCY BY IMPLEMENTING A SMARTER CONTROLLER**
Kenny Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. California State Polytechnic University, Pomona, 3801 W. Temple Avenue, Pomona, CA 9176

122 3;40 **PROPARGYL METHYL ETHERS: NOVEL PRECURSORS TO COBALT-COMPLEXED PROPARGYL CATIONS**
Sarine Shahmirian and Gagik G. Melikyan. California State University Northridge, Department of Chemistry and Biochemistry, Northridge, CA, 91330

123 4:00 ***EQUUS* MATERIAL FROM THE LA HABRA FORMATION, RALPH B. CLARK REGIONAL PARK, BUENA PARK, ORANGE COUNTY, CALIFORNIA.**
M.K. Crowe and L. Babilonia, Ralph B. Clark Regional Park, Interpretive Center, 8800 Rosecrans Ave. Buena Park, CA, 90621.

ABSTRACTS IN PROGRAM ORDER

1. RECONCILING FISHING WITH ENVIRONMENTAL SUSTAINABILITY

Mark Helvey. NOAA National Marine Fisheries Service, Southwest Region, Sustainable Fisheries Division, Long Beach, CA 90802.

Federal fisheries in the United States are managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The primary intent of the MSA is to contribute sustainable fishery resources to the Nation while protecting the environment through reducing or minimizing the capture and subsequent discard of non-target species. In addition, commercial fisheries that interact with marine species protected or listed under U.S. federal laws including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) may be managed further to reduce incidental interactions or mortalities. The result of these intertwined statutes is that U. S. fishermen are managed by stringent and measurable restrictions relative to foreign fishing fleets. The presentation looks at some of the technological and operational requirements placed on U. S. fishermen. It concludes by pointing out that greater reliance on U.S. fishermen operating under the provisions of MSA, ESA and MMPA can assist in meeting consumer demand while contributing to ecosystem sustainability.

2. ASSESSING POST-RELEASE MORTALITY FOR COMMON THRESHER SHARKS CAPTURED IN THE SOUTHERN CALIFORNIA RECREATIONAL FISHERY

C. Heberer[1], C.A. Sepulveda[2], S.A. Aalbers[2], D. Bernal[3], and S. Kohin[4]. [1]National Marine Fisheries Service, Southwest Region, 6010 Hidden Valley Drive, Carlsbad, CA. 92011; [2]Pfleger Institute of Environmental Research, Oceanside, CA; [3]University of Massachusetts, Dartmouth, Dartmouth, MA; [4]National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.

The common thresher shark, *Alopias vulpinus*, is one of 13 species managed under the Federal Fishery Management Plan for U.S. West Coast Highly Migratory Species (HMS) Fisheries. In southern California there is a popular recreational fishery that targets thresher sharks utilizing heavy troll gear with large J-hooks resulting in a high percentage of sharks foul-hooked by the tail. A NOAA Fisheries Bycatch Grant was awarded to: (1) assess the survivorship of captured and released thresher sharks, (2) quantify the physiological indicators of capture stress associated with both tail-hooked and mouth-hooked individuals, and (3) investigate gear modifications that may enhance survivorship. A total of 28 sharks were caught and released during the 2008 season with the large majority (93 percent) tail-hooked. Twelve pop-up satellite transmitters were deployed to assess survivorship and preliminary findings suggest a post-release mortality estimate of 17 percent for the sharks sampled thus far (155–230 cm FL). All adult tail-hooked thresher sharks (> 155 cm FL) captured were tagged and released. Once at the boat the sharks appeared exhausted and lethargic; however, all individuals with fight times less than 85 minutes survived the acute effects. The two largest individuals with fight times in excess of 105 minutes did not survive. These preliminary data suggest that large tail-hooked thresher sharks exposed to prolonged fight times have increased mortality rates when compared to smaller individuals. Further NOAA Fisheries Bycatch Reduction and Engineering-funded work will be conducted in 2009 on larger individuals to more fully evaluate this work.

3. SEALED OFF FROM THE FISH: EVALUATING A MODIFICATION TO PREVENT MARINE MAMMAL DEPREDATION ON CALIFORNIA HALIBUT TRAWL GEAR

D. Lawson. National Marine Fisheries Service, Southwest Regional Office, Protected Resources Division, Long Beach, CA, 90803. L. Enriquez and C. Villafana. National Marine Fisheries Service, Southwest Regional Office, Sustainable Fisheries Division, Long Beach, CA, 90803. M. McCorkle and M. Castagnola. Commercial Fisherman, Santa Barbara, CA, 93109.

One contentious issue surrounding fishing in California is the impact of marine mammal depredation on both commercial and recreational fisheries. In general, effective deterrence methods that can be employed during fishing operations to prevent damage and loss of catch have not been developed. The California halibut trawl fishery is one fishery that has struggled to deal with depredation, especially from harbor seals, *Phoca vitulina*. In response, fishermen have developed a novel modification to their trawl net that can prevent or minimize the opportunity for mammals to access the fish. California halibut, *Paralicthys californicus*, is targeted as live with short tows, and most fish do not go into the codend but instead remain in the intermediate portion of the net. In order to prevent depredation, a small-meshed panel is sewn inside the intermediate section of the net which makes it difficult for animals to penetrate through the net to damage the halibut as the gear is being towed or hauled in. In order to formally document this problem and demonstrate the viability of this gear, fishermen approached biologist from the National Marine Fisheries Service (NMFS) to initiate a cooperative research project involving the use of underwater video camera technology. Initial documentation and assessment of the performance of this gear modification will commence in late April or early May of this year. This presentation will discuss the progress of the research up to date and the role of NMFS in helping to support and develop innovative bycatch reduction techniques.

4. NOAA FISHERIES SERVICE ETHICAL ANGLER PROGRAM

M.F. Golden. NOAA Fisheries Service, Long Beach, CA 90802.

There are many facets to achieving sustainable fisheries, including appropriate fishery regulations (quotas, bycatch reduction, gear restrictions, etc.), habitat protection and pollution control. Additionally, there are non-regulatory approaches for achieving sustainable fisheries that can complement regulations and/or negate the need for more restrictive regulatory approaches.

The United Nations adopted a code for responsible fishing in 1995, and in 1996, NOAA published a plan for implementing the code in U.S waters. Additional details for implementing the code in the U.S., with a focus on recreational fishing, were published by NOAA in 1999. The 1999 code of angling ethics has evolved into the NOAA Ethical Angler Program with an updated more user friendly code.

The focus of the NOAA Ethical Angling Program is to educate anglers to be better conservationists. The program encourages anglers to practice stewardship, pollution prevention, bycatch reduction, and good resource management. The ethical angler code also addresses the importance of preventing the spread of non-native species, following regulations, and respecting property rights.

The cornerstone of the code is centered on bycatch reduction using appropriate catch-and-release techniques, fishing gear, taking only what you plan to eat, and minimizing interactions with seabirds, turtles, and marine mammals. The reward for the ethical angler is a better fishing experience.

Copies of the code of ethical angling and related material are located on the NOAA Fisheries Service web site at http://www.nmfs.noaa.gov.

5. FISHES AND FISHING IN THE LOS ANGELES RIVER

Sabrina L. Drill[1] and Camm Swift[2]. [1]UC Cooperative Extension, Los Angeles County, 4800 E. Cesar Chavez Ave., Los Angeles, CA 90022; [2]Entrix, Inc. 2140 Eastman Ave # 200, Ventura, CA 93003.

Fishing in lakes, impoundments, and streams is an important avenue for urban dwellers to connect with nature. In some areas, urban fishing is promoted through special programs such as fishing derbies, and non-native fishes are stocked to augment fish populations. In other areas, fishing activity occurs "under the radar" of resource agencies, may or may not be legal, and may provide recreational, commercial, and subsistence benefits. Where fishing activity occurs it is important to examine the health impacts of fish consumption in light of the potentially degraded quality of urban waters. We examined the fish community in channelized portions of the Los Angeles River where fishing is known to occur, and examined fish tissues for contamination. Of the eight fish species captured, none were native to the watershed. Catches were dominated by the small species *Gambusia affinis* and *Pimephales promelas*. The most common "table fish" were tilapia (*Oreochromis* sp.), green sunfish (*Lepomis cyanellus*), common carp (*Cyprinus carpio*), and black bullhead (*Ameiurus melas*). Samples of bullhead, carp, sunfish, and tilapia were tested for PCB's and mercury, and were below recommended limits for consumption. Future work

will characterize the fishers themselves. There is some controversy over whether fishing in these areas is, or should be, allowed. We will frame this debate and discuss what role fishing could play in enhancing utilization of the Los Angeles River as an amenity, and what role urban freshwater fishing in general can play in promoting sustainable use of aquatic resources.

6. THE NATIONAL MARINE FISHERIES SERVICE SOUTHWEST REGION OBSERVER PROGRAM'S ROLE IN REDUCING BYCATCH AND MANAGING SUSTAINABLE FISHERIES.

L. Enriquez. National Marine Fisheries Service, Long Beach, CA, 90802. C. Villafana. I.M. Systems Group. Rockville, MD, 20852.

The National Marine Fisheries Service (NMFS) utilizes observer programs to monitor the catch of target and non-target species in commercial fisheries. NMFS Southwest Region (SWR) has sent observers to sea since the 1970's beginning with the tuna/dolphin observer program, which monitored purse seine vessels operating in the Eastern Tropical Pacific Ocean. Since 1990, the SWR has placed observers in gillnet, longline, coastal purse seine, and hook-and-line fisheries. Observer data have been used to implement bycatch reduction measures in these fisheries, including gear modifications and time/area closures.

The NMFS SWR continues to observe the California/Oregon drift gillnet fishery to obtain statistically reliable estimates of incidental mortality and serious injury of marine mammals. From 1990 through 2008 observers monitored 1,410 drift gillnet trips, with annual coverage rates ranging from 4% to 20%. While the observers' primary duty is to collect marine mammal bycatch data and biological samples, the commercial fishing vessel provides an excellent platform for collecting samples from other species to aid in their management.

California/Oregon drift gillnet observer samples have been used to establish the existence of two species of common dolphin; Short-Beaked (*Delphinus delphis*) and Long-Beaked (*D. capensis*). Observers have collected stomachs from co-occurring common thresher sharks (*Alopias vulpinus*), shortfin mako sharks (*Isurus oxyrinchus*) and blue sharks (*Prionace glauca*) to determine their feeding habits when captured in the same time and area. Current drift gillnet observer projects include blue shark (*Prionace glauca*) post-release mortality studies and swordfish (*Xiphias gladius*) and opah (*Lampris guttatus*) stock structure determination.

7. FEDERAL STATUTORY FRAMEWORK FOR ACHIEVING ECOSYSTEM SUSTAINABILITY DURING FISHING OPERATIONS IN CALIFORNIA

Christina C. Fahy. National Marine Fisheries Service – Southwest Regional Office; 501 W. Ocean Blvd.; Suite 4200; Long Beach, California 90802.

Federal fisheries in the United States are conserved and managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The primary intent of the MSA is to contribute sustainable fishery resources to the national food supply, economy, and health of the United States as well as to provide recreational opportunities. Specific provisions in the MSA, however, require these objectives be met while protecting the environment through reducing or minimizing bycatch, the capture and subsequent discard of non-target species that lack commercial value or are under management measures requiring they not be landed. In addition, commercial fisheries that interact with marine species protected or listed under U.S. federal laws such as the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) may be managed further to reduce interactions or mortalities. The California/Oregon drift gillnet (DGN) fishery targeting swordfish (*Xiphias gladius*) and thresher shark (*Alopius vulpinus*) and the purse seine fishery targeting yellowfin tuna (*Thunnus albacares*) are examples of where NOAA's National Marine Fisheries Service has used several management approaches to minimize the bycatch of marine mammals and sea turtles protected and/or listed under the MMPA and ESA, respectively. For example, the DGN fishery requires fishermen to use pingers on their nets to alert small cetaceans to their presence, and time/area closures are in place to protect leatherback sea turtles (*Dermochelys coriacea*). In addition, purse seiners harvesting tuna are required to comply with the International Dolphin Conservation Program to reduce dolphin mortality.

8. CENTRAL COAST GROUNDFISH PROJECT: PARTNERSHIP DRIVEN EFFORT TO IMPROVE CONSERVATION OF GROUNDFISH RESOURCE THROUGH FISHING HARVEST REFORM

Michael Bell. Project Director, The Nature Conservancy, San Luis Obispo, CA, 93401.

Overreliance on bottom trawling in the west coast groundfish industry has led to high bycatch rates and seafloor habitat impacts that greatly contributed to regulatory constraints and a drastic decline in the fishery's economic performance.

The Nature Conservancy (TNC) is collaborating with fishermen to test how diversifying harvest methods beyond traditional bottom trawling, with alternative gear types can contribute to the economic performance of the fishery, rebuilding of fish stocks and conservation of seafloor habitat.

As part of this effort, we are using private conservation fishing agreements - leases of TNC-owned fishing permits under geographic, gear, and monitoring requirements. In 2008, 5 such projects were launched that test the benefits of different groundfish harvest methods, including: 1) Scottish seine gear, 2) modified trawl and 3) hook and line gear while using collective harvest planning among fishermen to avoid depleted species. These fishing demonstration projects also serve as platforms for unprecedented cooperative research that will help evaluate adapt fishery reform efforts.

9. STUDIES OF TWO INDIGENOUS FLATFISH, PACIFIC SANDDAB AND ENGLISH SOLE, IN SANTA MONICA BAY – SEASONAL AND LOCATION-ASSOCIATED DIFFERENCES IN SEX STEROID LEVELS

D.M. Petschauer, C. Cash, J.A. Reyes, and K.M. Kelley. Environmental Endocrinology Lab, Marine Biology Program, California State University, Long Beach, Long Beach, CA 90840.

This field-based endocrine study was aimed at characterizing sex steroid levels in wild flatfish residing within Santa Monica Bay, in terms of potential differences in reproductive seasonality in different species and whether alterations may occur when sampling fish near to or away from the Hyperion Treatment Plant outfall location. Both Pacific sanddab (*Citharichthys sordidus*) and English sole (*Parophrys vetulus*) showed expected sex-related differences in plasma concentrations of 17β-estradiol (E2; higher in females, $p<0.05$) and testosterone (T; higher in males, $p<0.05$). In addition, these steroids exhibited significantly higher levels ($p<0.05$) in each species' respective reproductive season (summer in sanddab; winter in sole). E2 concentrations were not significantly altered in either species in fish residing at the outfall location as compared with fish from a site offshore of Malibu, and this was true in both sexes. However, in English sole males during their winter reproductive season, fish sampled at the outfall exhibited significantly higher T concentrations. Reproductive sanddab females also exhibited significantly higher T concentrations when sampled from the outfall location. These results point to possible outfall-associated effects on gonadal steroid production during the reproductive season of flatfish, when their steroidogenic pathways are most active. [Supported by Southern California Sea Grant Program NOAA#NA06OAR4170012].

10. BATHYMETRIC RESPONSES IN FUNCTIONAL STRUCTURE OF SOUTHERN CALIFORNIA SOFT-BOTTOM FISH COMMUNITIES TO CHANGING OCEAN CONDITIONS

M.J. Allen. Southern California Coastal Water Research Project, Costa Mesa, CA 92626.

Regional surveys of soft-bottom fishes in the Southern California Bight (SCB) during the past 35 years have provided data for assessing changes in fish abundance and bathymetric distributions of species, and for describing the functional organization of communities. Soft-bottom fish communities of the SCB have a functional structure consisting of about 18 foraging guilds with species of a guild forming a depth-displacing series of ecological counterparts. This study describes bathymetric shifts in the functional organization of demersal fish communities on the continental shelf during a Pacific Decadal Oscillation (PDO) cycle and an El Niño. Changes in depth-displacement patterns during these oceanic periods varied by guild. El Niño effects on these patterns included expansions or contractions of depth ranges of some guild members, retreats of some guilds to deeper water, and intrusions of new dominant guild members from the south. Changes between warm and cold regime periods were less pronounced but gradual

declines in the occurrence of some deep-living guild members were apparent, suggesting decreased recruitment from the north. Patterns of several guilds were identical or nearly so in the two PDO cold regimes, with the second suggesting a resilient return to baseline cold-regime patterns. Changing depth replacement patterns of species within foraging guilds provided a basis for understanding disruptive effects and resilient responses of soft-bottom fish communities to changing ocean conditions. Understanding how fish populations and communities change in response to natural changes ocean conditions will contribute to ecosystem management of anthropogenic effects on southern California fish populations and communities.

11. SPAWNING-RELATED MOVEMENTS OF BARRED SAND BASS, *PARALABRAX NEBULIFER*, IN SOUTHERN CALIFORNIA: INTERPRETATIONS FROM TWO DECADES OF HISTORICAL TAG AND RECAPTURE DATA.

E.T. Jarvis, C. Linardich, and C.F. Valle. California Department of Fish and Game, Marine Region, Los Alamitos, CA, 90720.

The southern California recreational fishery heavily targets barred sand bass, *Paralabrax nebulifer*, in the summer when they form large spawning aggregations over soft bottom habitat. Despite decades of popularity as a sport fish, we still know little about the spawning-related movements of barred sand bass. During the 1960s and 1990s, the California Department of Fish and Game tagged nearly 9,000 sand bass in southern California. Tagging primarily occurred at historical spawning grounds (e.g. Huntington Beach Flats) during spawning season (Apr–Oct), except for fish tagged year-round in Newport Bay. Our objectives were to examine these historical data for trends in 1) residence times on spawning grounds, 2) movement to non-spawning season residences, and 3) breeding site fidelity. Overall, 972 fish were recaptured (an 11% recapture rate), although returns were higher in the 1960s than the 1990s. Recaptures within a spawning season suggested an approximate residence time of 1–2 month(s) at the spawning location. Recapture distances from spawning grounds were variable among individuals. Sixty-four percent of winter recaptures were close to spawning grounds (within 1 km) while 36% were on average 13 km away, indicating a proportion of the population migrates longer distances to spawn. Overall, the farthest recapture distance was ~ 92 km. Annual patterns in the timing and occurrence of recaptures strongly suggest breeding site fidelity. Although these data provide a better understanding of barred sand bass behavior, many questions remain unanswered. Further research on the fine-scale movements of this species during spawning season may provide additional information important for future management consideration.

12. HABITAT USE AND THE EFFECTS OF HABITAT BREAKS ON THE MOVEMENTS OF TEMPERATE GAMEFISHES IN A SOUTHERN CALIFORNIA MARINE PROTECTED AREA

T. Mason and C.G. Lowe. California State University Long Beach, Department of Biological sciences, Long Beach, CA, 90840.

Studies that investigate how landscape features (e.g. habitat edges) affect fish distributions typically measure fish densities across different habitats; however, it is also of interest to determine how landscape features may affect movement patterns, both on an individual and species scale. We used acoustic telemetry methods coupled with a GIS to measure the spatial use of habitats and edge response for four temperate gamefishes (barred sand bass, *Paralabrax nebulifer*; kelp bass, *P. clathratus*; ocean whitefish, *Caulolatilus princeps*; and California sheephead, *Semicossyphus pulcher*) at the Catalina Marine Science Center Marine Life Refuge located at Santa Catalina Island, California. Barred sand bass, California sheephead, and ocean whitefish exhibited a positive rock/soft-sediment edge response (i.e. primarily relocated near edge habitat), while kelp bass exhibited a negative edge response. In addition, we monitored the movements of individuals translocated up to 1 km to contiguous and discontinuous reefs. Results suggest deep soft-sediment habitat may restrict movements of California sheephead and kelp bass to adjacent reefs. Rocky and shallow soft-sediment habitats did not appear to restrict inter-reef movements of the four species studied. These data are important for designing Marine Protected Areas with geographic boundaries that are biologically relevant.

13. FIELD RESEARCH AT CABRILLO MARINE AQUARIUM: LONG-TERM MONITORING OF LOCAL MARINE HABITATS

Julianne E. Kalman. Cabrillo Marine Aquarium. 3720 Stephen M. White Drive, San Pedro, CA 90731.

Cabrillo Marine Aquarium (CMA) engages all visitors in education, recreation, and research to promote knowledge, appreciation, and conservation of the marine life of southern California. Research at CMA consists of staff, volunteer, and student projects in both long-term monitoring of local marine habitats and laboratory-based husbandry projects. Currently, CMA is conducting three long-term monitoring projects: 1) The *Peninsula Shorewatch* began in 1975 to monitor specific rocky intertidal species along the Palos Verdes Peninsula likely affected by people. This project has developed into an annual survey in collaboration with faculty at California State University, Long Beach with a dataset of 30+ years that has captured the rise and fall of many species such as the black abalone, *Haliotis cracherodii*. 2) Beginning in 1997, the *Salt Marsh Survey* consists of biannual surveys of organisms living in the manmade salt marsh (Salinas de San Pedro). This survey will help determine future directions as marsh enhancements are planned. 3) The *Inner Cabrillo Beach Survey* began in 2006 as a way to monitor the affects, if any, of the sand replenishment project. The Port of Los Angeles and other City of Los Angeles agencies have collaborated to identify potential causes of poor water quality at Cabrillo Beach. Fine-grained sand was replaced with coarser sand in the upper portion of the beach in spring of 2007 and they have continued to replace sand down into the intertidal in spring 2009. Preliminary analyses suggest no significant difference in species abundance or diversity after the initial 2007 removal.

14. MEGABENTHIC INVERTEBRATES OF THE UPPER CONTINENTAL SLOPE OFF SOUTHERN CALIFORNIA

Don Cadien. Marine Biology Lab, Sanitation Districts of Los Angeles County, Carson, CA, 90745.

The upper slope (200–500 m) in the Southern California Bight (SCB) is a zone of transition from the fauna of the outer continental slope to that of deeper portions of the borderland. Few species find firm limits at the nominal division between the shelf and slope; the shelf break. This varies in depth locally between 80 and 200 m, depending on local physiography. Many shelf animals continue onto the slope, finding their deepest occurrences on the upper slope. Some also continue deeper to the lower slope or even abyssal depths. The converse is also true, with species characteristic of mid to lower slope depths (500–2000 m) reaching their shallow distributional limits on the upper slope. Bottoms there are quiet, dark, and predominantly silty; currents are usually slower than near the shelf break or on the shelf. Echinoderms form the biomass and abundance dominants in this life-zone, with mollusks, arthropods, and cnidarians also well represented. Sponges have scattered representation on soft bottoms, but become dominant on hard outcroppings. A cast of characters often seen in trawl samples from these depths in the SCB will be presented.

15. CAN SEDIMENT PROFILE IMAGING ENHANCE TRADITIONAL BENTHIC ASSESSMENTS?

J. Ananda Ranasinghe[1] and Giancarlo Cicchetti[2]. [1]Southern California Coastal Water Research Project (SCCWRP), Costa Mesa, CA 92626 and [2]US Environmental Protection Agency, Narragansett, RI 02882.

Managing sediments based on benthic community condition is appropriate because these invertebrates are reliable and sensitive indicators, and living resources that environmental legislation intends to protect. However, assessment results are often available only months or years after sample collection due to the time necessary to process traditional benthic samples. Therefore, SCCWRP is evaluating alternate methods to expedite benthic assessments. One of the methods being evaluated is Sediment Profile Imagery (SPI), where photographs of vertical sediment profiles are analyzed to assess sediment condition. SPI indices are species-independent and can be applied to any soft-bottom area worldwide for an initial

assessment. However, in general, they lack the resolution of well-developed, locally-tuned faunal indices. SCCWRP is evaluating two aspects of SPI performance as part of the Bight'08 Regional Monitoring Program. First, side by side comparisons of traditional and SPI assessment results are being conducted at 74 sites in Los Angeles - Long Beach Harbor and San Diego Bay. Second, SPI is being used to map benthic gradients at the mouth of Chollas Creek, an area of management interest where condition gradients are known to exist from previous studies.

Preliminary results indicate that SPI successfully identified gradients at the mouth of Chollas Creek. Although SPI will probably not replace traditional benthic assessments because organisms cannot be accurately identified or enumerated from images, it provides additional information on community function. The rapid SPI sampling and processing turnaround time may permit increased spatial coverage and help focus traditional benthic assessment where it is most useful.

16. THE SANDY BEACH ECOSYSTEM AS AN INTEGRATED WHOLE: COMPONENTS, CONNECTIONS, AND CONCERNS

K.L. Martin and J.E. Dugan. Pepperdine University, Department of Biology, Malibu, CA, 90253 and University of California, Santa Barbara, Marine Science Institute, Santa Barbara, CA, 93106.

California beaches attract millions of people and up to $17 billion every year, but the sandy beach habitat has not enjoyed commensurate scientific attention. As with all coastal areas, beaches are the interface between the terrestrial and marine environments, subject to numerous human and natural impacts and under diverse jurisdictions for management. Sandy beaches are characterized by a highly mobile substrate, lack of attached plants within the tidal reach, and diverse intertidal fauna. California beaches can have a particularly high biodiversity and abundance of invertebrates and shorebirds relative to worldwide. Beaches provide nursery, foraging, and resting habitat for many species of birds, fish, invertebrates, marine mammals, and reptiles. Considering the beach as an integrated ecosystem is vital to promoting scientific understanding of the biodiversity and the unique flora and fauna that depend on this setting. An integrated approach that considers all components of the ecosystem is more likely to be able to maintain or restore biodiversity and ecological function to this vital habitat. We discuss the components of sandy beaches, the connections between the different zones, and some concerns for management and restoration of sandy beach habitat in California.

17. INDICATION OF PROTEIN PRESERVATION IN THE FOSSIL WHALE BONES OF THE MIOCENE/PLIOCENE PISCO FORMATION, PERU

U.L. Vidal[1], D.S. Boskovic[1,2], and L.R. Brand[1]. [1]Department of Earth and Biological Sciences, School of Science and Technology, Loma Linda University, Loma Linda, CA, 92350; [2]Division of Biochemistry, School of Medicine, Loma Linda University, Loma Linda, CA, 92350.

Generally, preservation of original protein in fossilized remains is unexpected. The well documented diagenesis of biological tissues ordinarily includes relatively rapid degradation of all biomolecules, including protein. Since the 2005 reports describing still elastic and resilient blood-vessel like structures in preparations of bone samples from *T. rex*, and additional 2007 descriptions of its collagen protein sequence, molecular paleontology has indeed become the focus of much attention. In this study, our objective is to assay for protein preservation in the fossil baleen whales of the Miocene/Pliocene Pisco Formation from Peru. The sediment in which the bones are embedded is mostly sandstone or diatomaceous siltstone. Our preliminary results are as follows. We used transmitted and reflected microscopy to assay the general structural preservation of the fossil bones. Under the light microscope, structures that look like branching blood-vessels, running through the partially demineralized fossil bone were identified. Those structures were easily cracked, and behaved very much like glass. Other structures that looked like Osteocyte Lacunae were also clearly visible. After demineralization with EDTA and extraction with GuHCl, we used C8 Extraction columns to trap the proteins from the solution. The eluate from the extraction columns then was tested through UV-absorbance and BCA protein assay. Both assays were indicative of protein presence. The amount of protein present, as shown by the BCA assay, was 12.2 μg/g fossil sample. The samples analyzed were identified as being ribs and vertebral fragments. Further efforts are currently under way to identify the major proteins.

18. SLUG SEX, REPRODUCTIVE INTERFERENCE, AND ALLEE EFFECTS AT A SHIFTING RANGE BOUNDARY

A.S. Llaban and P.J. Krug. California State University Los Angeles, Department of Biological Sciences, Los Angeles, CA 90032.

At the edge of a species' range, low densities and competition from related species may result in negative Allee effects (density-dependent reduction in fitness). We studied how interactions between two marine gastropods contribute to their seasonally fluctuating range boundary in San Francisco Bay. The sister species *Alderia modesta* and *Alderia willowi* alternate in abundance over the year, where high recruitment of one species usually precedes local extinction of the other. We manipulated densities in lab experiments to test whether mating by hypodermic insemination allows the more common species to decrease fitness of the rarer species, by tissue damage or flooding with incompatible sperm. Within each species, higher densities resulted in lower reproductive output due to costs of mating by hypodermic insemination. Negative interactions between the sister species were asymmetric: higher densities of *A. modesta* lowered the fitness of *A. willowi*, whereas higher densities of *A. willowi* did not affect *A. modesta*. The larger *A. modesta* inflicts substantial damage on the smaller *A. willowi* during mating, and may thus inhibit colonization or accelerate the extinction of the few *A. willowi* that survive the winter rainy season. Molecular analysis of offspring produced during lab mating trials showed no introgression of species-specific nuclear alleles, and we found no evidence of hybridization in field populations containing both species. Presence of conspecific egg masses induced greater egg production, suggesting additional Allee effects may result if pheromones that cue oviposition are not encountered when slug densities are low.

19. THE ENDANGERED MORRO BAY KANGAROO RAT *DIPODOMYS HEERMANNI MORROENSIS* IN SAN LUIS OBISPO COUNTY, CALIFORNIA: 2008.

C.P. Kofron and F.X. Villablanca. U.S. Fish and Wildlife Service, Ventura, CA; and Department of Biological Sciences, California Polytechnic State University, San Luis Obispo.

The Morro Bay kangaroo rat is endemic to Los Osos, San Luis Obispo County, California. The taxon comprises a single, geographically isolated population with a range of 4 to 5 square miles. The Morro Bay kangaroo rat was listed as endangered in 1970, and the last capture occurred in 1985. We are searching for the Morro Bay kangaroo rat at historical sites within the geographic range, and also at adjacent and nearby sites. Our methods include habitat assessments, searching for distinctive signs, and trapping. This is a team effort of California Polytechnic State University, the California Department of Parks and Recreation, the California Department of Fish and Game, and the U.S. Fish and Wildlife Service, with assistance from numerous private landowners. We will review the search effort in 2008 and present the plan for 2009.

20. FROM DOT LOCALITIES TO AN UPDATED DISTRIBUTION MAP: REFINING THE DISTRIBUTION PATTERN OF THE RARE "COMMON GARTERSNAKE" (THAMNOPHIS SIRTALIS) IN THE SEMI-ARID SOUTH COAST BIOREGION OF CALIFORNIA.

Edward L. Ervin[1] and Clark R. Mahrdt[2]. [1]Associate Biologist, Merkel & Associates, Inc., 5434 Ruffin Road, San Diego, CA 92123; [2]Research Assistant, San Diego Natural History Museum, Dept. of Herpetology, P.O. Box 121390, San Diego, CA 92112-1390.

Since 1994 many experts have suggested that the common gartersnake (*Thamnophis sirtalis*) occurring in the South Coast Bioregion may be an undescribed form. However, to date very little has been reported about *T. sirtalis* within this region.

As part of our ongoing effort to understand the ecology, life history, and taxonomic status of *T. sirtalis* within the South Coast Bioregion, we set out to first clarify its distribution in relation to biotic and abiotic factors. However, since not all locality records are of equal utility for mapping purposes it was necessary to develop and apply a strict set of criteria to evaluate all available records for acceptable levels of reliability, precision, and accuracy.

To create a visual representation of the distribution pattern we plotted 80 unique dot localities on a GIS shapefile map that represent a total of 137 'cleaned' records. After evaluating, mapping, and analyzing the distribution pattern, our results strongly suggest that within the topographically complex South Coast Bioregion the two essential site factors that best explain the highly disjunct distribution pattern of *T. sirtalis* is the combination of both low gradient terrain and perennial surface water. We will present our dot locality distribution map and discuss our results in regard to the potential for occurrences of *T. sirtalis* at additional areas within the South Coast Bioregion.

21. FLUCTUATING AND TRANSLATIONAL ASYMMETRY AS INDICATORS OF STRESS FOR COASTAL WETLAND PLANTS

LaRie Burgoyne, Daryle Hinton-Hardin, Gianna Ramos, Mackenzie Shribbs, and Dr. Philippa M. Drennan. Loyola Marymount University, Department of Biology, Los Angeles, CA 90045.

Asymmetry can be used as a measure of developmental instability and thus possibly serve as an indicator of environmental stress. Fluctuating asymmetry (FA), the small, completely random departures from bilateral symmetry (often determined for leaves) provides a surprisingly convenient measure of developmental precision: the more precisely each side develops, the greater the symmetry. Translational asymmetry (TA), determined from the curve-fitting accuracy of internode length versus internode number, is suggested to be a more sensitive measure of environmental stress. The relationship between FA, TA, and environmental conditions is being tested for the halophyte *Jaumea carnosa* (fleshy jaumea) in the coastal Ballona Wetlands. Fleshy jaumea was collected from sites along the intertidal channel that differed in salinity, soil water content, and soil texture. To determine FA, the width of the lamina on each side of the midvein along the length of the leaf was measured. Statistical testing of FA for leaves of similar development and standardized for size differences showed significant differences between sites: in particular FA was greatest for leaves taken from sites farther away from the intertidal channel. Also, when comparing the widths of each individual leaf, FA was greatest for the bottom third nearest the stem. The FA asymmetry results are currently being compared with TA of the same specimens to determine if these two measures respond similarly to the environmental stresses. Additionally, TA is being investigated for another coastal wetland species, *Salicornia virginica* (pickleweed) for which FA measures cannot be readily applied as this species is a stem succulent.

22. EVALUATING CONTAMINANTS IN AN ENDANGERED SPECIES INHABITING AN URBANIZED COASTAL ECOSYSTEM: *BIOACCUMULATION AND HEALTH EFFECTS IN THE EAST PACIFIC GREEN TURTLE (CHELONIA MYDAS) IN SAN DIEGO BAY*

Lisa Komoroske[1], Rebecca Lewison[1], Peter H. Dutton[2], Jeffrey Seminoff[2], and Dimitri Deheyn[3]. [1]San Diego State University; [2]NOAA- Southwest Fisheries Science Center; [3]Scripps Institution of Oceanography.

Many trace metals and persistent organic pollutants have been found to exceed probable effects levels in sediment and water of the San Diego Bay (SDBay) where a population of East Pacific green turtles (*Chelonia mydas*) are known to forage and reside throughout the year. However, the impact of these pollutants on East Pacific green turtles that rely on SDBay is unclear. In 2007–2008 non-invasive blood and scute sampling was used to measure these contaminants in 21 individuals in the SDBay population. Food sources from nine sites in the Bay were analyzed to investigate biomagnification and identify specific foraging areas. Hematology was used to investigate correlations of contaminant load and health. Principle Components Regression and MANOVA were used to assess relationships between toxin levels, health status, and bioaccumulation in the green turtle food web. In blood samples, an indicator of recent contaminant exposure, juveniles were found to have significantly higher blood levels of copper, cadmium, and selenium than adults. Lead was found to be significantly higher in the blood of adults relative to juveniles. In scute samples, an indicator of more long-term exposure, levels of arsenic were higher in juveniles while aluminum, copper, iron, strontium, titanium, and vanadium were all significantly higher in adults. Principal components derived from the trace metals in whole blood had several significant relationships with health variables such as lymphocyte count and total protein. These results suggest that contaminant levels in SDBay may negatively influence individual and population health in this foraging

area. However, clinical signs of disease, declining body condition, or other morphological indicators of health effects were not observed. Future work should focus on understanding the effects of the altered hematological variables on overall fitness and reproductive success.

23. EVERYONE CAN MAKE A DIFFERENCE: REDUCING GREENHOUSE GAS EMISSIONS AT THE LOCAL LEVEL.

Dalkey A. Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274.

Can climate change be stopped, slowed, mitigated in some way or not? Responses to this question can be wide-ranging and pessimistic or optimistic. However, we can be certain that reducing emissions of greenhouse gas won't hurt and may help. John Mott-Smith, Climate Change Advisor in Yolo County has dedicated his retirement to the reduction of greenhouse gas emissions at the local level using a list of 25 things that everyone can employ. This session will explore these 25 items along with an overview of greenhouse gas sources.

24. THE IMPACT OF GLOBAL CLIMATE CHANGE ON SOUTHERN CALIFORNIA: IMPLICATIONS ON WATER RESOURCES, WILDFIRES, AND AIR QUALITY

Kim, Jinwon. Joint Institute For Regional Earth System Science and Engineering/Department of Atmospheric and Oceanic Sciences, University of California Los Angeles.

The ongoing global climate change can greatly affect the southern California region in various sectors, most importantly water resources, wildfire, and air quality. For example, southern California relies heavily on water resources imported from northern California and the Colorado River basin. With ever increasing demand for water resources and almost permanently limited availability of, even minor fluctuations in precipitation can induce serious water resources crisis in the region. Intense research efforts over the last two decades show, with high certainty, that the anthropogenic emissions of greenhouse gases has already started altering the climate and that the climate trend will persist over the present century even if dramatic measures for reducing emissions are implemented immediately. Thus, projecting the impact of global climate change on regional sectors has become an important task to mitigate the adverse impact of the global climate change.

The UCLA-JPL Joint Institute for Regional Earth System Science and Engineering (JIFRESSE) has been recently established for advancing our capability in projecting the impact of global climate on California by combining the capability of the two research institutions in earth science, numerical modeling, and remote sensing. As a part of the joint effort, we are developing the JIFRESSE Regional Climate System Model (RESM) by nesting numerical models for regional atmospheric circulation and land-surface processes (WRF), a regional ocean circulation model (ROMS), and an operational regional air quality model (CMAQ). Recently, the impact of global climate change on California region during the mid-20th century period has been investigated using on the basis of dynamical downscaling of a global climate scenario using JIFRESSE RESM. The global climate scenario has been generated by the National Center for Atmospheric Research (NCAR) on the basis of the IPCC SRES-A1B emission scenario.

The results show that the low-level temperature in California will increase by 1–2.5 C, with larger increases in high-elevation regions. Noticeable decreases in snowfall, snow-water equivalent, and surface albedo in high-elevation regions in the projected mid-21st century climate suggest that the temperature increases in the high-elevation regions are partially amplified by local snow-albedo feedback. Precipitation and the snow-portion of it decrease over the entire cold season. The decrease in snowfall results in the reduction in snowmelt, seasonal-mean snow-water equivalent, and runoff during the cold season, especially in high-elevation regions. The decrease in the high-elevation snowpack is of a special concern, as it is among the main sources of warm season water supply in California. The frequency of Santa Ana winds that are closely related with wildfires in southern California may decrease because the larger warming over land than ocean tends to decrease the katabatic component of the forcing. The alterations in the surface O3 concentration in response to the changes in low-level temperatures and humidity will also be presented.

25. CLIMATE CHANGE IMPACTS ON WATER RESOURCES IN SOUTHERN CALIFORNIA

Jeremy S. Pal. Loyola Marymount University, Seaver College of Science and Engineering, Department of Civil Engineering and Environmental Science, Los Angeles, CA 90045. . Sara A. Rauscher. Los Alamos National Lab, T-3 Fluid Dynamics, Los Alamos, NM 87545. . Noah S. Diffenbaugh. Purdue University, Department of Earth and Atmospheric Sciences, West Lafayette, IN 47907.

Temperature and precipitation are virtually certain to substantially change over the next century in response to anthropogenically enhanced greenhouse forcing. Such changes will impact a wide variety of natural and human systems resulting in dramatic ecological, economic, and sociological consequences. This presentation focuses on the impacts of climate change on water resources in Southern California based on high-resolution climate 25-km model projections over North America. Compared to present day conditions, we find substantial modifications to the water budgets of many of the major river basins that supply water to Southern California. Most of the basins receive increased total annual runoff due to an overall increase in precipitation, despite increases in evapotranspiration. At the seasonal time scale, in basins where a large fraction of the runoff comes from snowmelt, there is a shift to earlier runoff due to the less snow and earlier melting. This is likely to strain existing water resources in Southern California, where little precipitation occurs during the summer season when water resources are in highest demand. Furthermore, while springtime soil moisture increases in many basins, it decreases during summer months, which could have detrimental impacts on agriculture.

26. STATUS, DISTRIBUTION, AND RELATIVE ABUNDANCE OF FISHES IN THE UPPER SAN GABRIEL RIVER BASIN.

J.W. O'Brien, H.K. Hansen, and M.E. Stephens. California Department of Fish and Game, 4665 Lampson Ave, Suite C, Los Alamitos, CA, 90720..

The Upper San Gabriel River (USGR) is one of the few basins in southern California that still supports an abundant endemic fish community and is widely recognized as an important area for the conservation of native fishes. To determine the status of native fishes within the USGR we surveyed approximately 75 kilometers of stream using snorkeling and electrofishing during 2007 and 2008. To assess distribution patterns over time, we compared our findings with published literature, unpublished reports, and field notes. The native fish assemblage consists of the federally threatened Santa Ana sucker, *Catostomus santaanae*, and two California Species of Special Concern: the Santa Ana speckled dace, *Rhinichthys osculus*, and the arroyo chub, *Gila orcutti*. Rainbow trout, *Oncorhynchus mykiss*, including possible strains of native coastal rainbow trout, also occupy the basin and were the most abundant and widely distributed fish species. Dace were the second most abundant and widely distributed fish species followed by sucker and chub. The common carp, *Cyprinus carpio*, was the only nonnative fish encountered, and giant reed, *Arundo donax*, and salt cedar, *Tamarix ramosissima*, were the primary nonnative invasive plants in the basin. Despite a large fire, flood, the two driest years on record, and continued impacts from recreational use and mining, the overall distribution of all four species is similar to basinwide surveys conducted in 1975 and 1991.

27. BIRD USE OF CONCRETE-BOTTOM AND NATURAL-BOTTOM HABITATS ON THE LOS ANGELES RIVER

R. Uyehara, **C. Kumpu**, and J.R. Thomlinson. Department of Biology, California State University Dominguez Hills, Carson, CA 90747.

The Los Angeles River is currently the subject of several restoration efforts. There have been discussions on removing the concrete bottom in the river and restoring it back to natural bottom. One question that arises from this idea is: "What would happen to the habitat of birds that use the hard bottom of the river?" We surveyed four fixed points on the river upstream and downstream of the Willow Street bridge, where there is a transition from hard to soft bottom, from September 12, 2008 through April 24, 2009. Two of the sites are on natural bottom and two sites are on concrete bottom. We have recorded about 45 species of

birds. Here we present the data on three of those species: American Avocet (*Recurvirostra americana*), Black-Necked Stilt (*Himantopus mexicanus*), and Long-Billed Dowitcher (*Limnodromus scolopaceus*). We discuss the different patterns of these three species in their use of natural versus concrete bottom, and how that changes seasonally. American Avocet and Black-Necked Stilt numbers peaked on the natural bottom in Fall but then on the concrete bottom in Spring, while Long-Billed Dowitcher was more common on the natural bottom throughout the study period.

28. BLACK FLY (DIPTERA: SIMULIIDAE) DISTRIBUTION, DIVERSITY, AND ANTHROPOGENIC INFLUENCES ON LARVAL ABUNDANCE IN THE UPPER SAN GABRIEL RIVER CATCHMENT (LOS ANGELES COUNTY, CALIFORNIA).

C.W. Solek. Southern California Coastal Water Research Project, Watersheds Department, Costa Mesa, CA, 92626.

The distribution and seasonal abundance of black fly larvae (Diptera: Simuliidae) were examined in relation to selected stream physical properties and other environmental variables in nine stream sites in the upper San Gabriel River catchment, Los Angeles County. In addition, the influence of recreational rock dams and littered trash on the abundance and species occurrence of larval black flies was investigated. A total of 12 morphologically distinguishable species of black flies in the genera *Simulium* and *Prosimulium* were collected from this catchment. Species composition and abundance was not the same among sites, and varied significantly throughout the year. Multi-response permutation procedures and indicator species analysis indicated very highly significant among-group differences in assemblage structure among the nine study streams. Elevation, slope, minimal channel alteration, substrate type, the presence of pools, algae, fines/fine gravel, increased conductivity and salinity, and indicators of channel modification by humans were the physical variables most related to the black fly species composition in streams. Ordination techniques did not reveal any patterns to suggest differences in the use and time to colonization of experimental trash substrates compared to natural substrates by black fly larvae. However, significant differences in the densities of black fly larvae that colonized the recreational rock dams, compared to locations upstream and downstream of the dams, were detected.

29. SETTLEMENT OF *OSTREA LURIDA* AS A FUNCTION OF TIDAL HEIGHT IN NEWPORT BAY, CALIFORNIA

L.A. Sam and D.C. Zacherl. California State University, Fullerton. Department of Biological Science.

Recent interest in restoration of *Ostrea lurida*, the native west coast oyster, motivates an interest in understanding factors influencing population persistence. Not only survival of adults, but also settlement of spat can affect the persistence of future generations. Processes controlling settlement dynamics of this species are of particular concern because we can exploit natural settlement of spat for seeding restoration habitat. Here, we examined the effect of tidal height on settlement rates in Newport Bay, CA using replicate stationary PVC pipe arrays (n=4) that suspended 15.3 cm × 15.3 cm PVC tiles at different tidal heights during two consecutive tide series. Settlement varied inversely with tidal height (Two-way ANOVA, $p<0.0001$) and among tide series ($p=0.02$). Results from this study also suggested that tile distance from the mudflat bottom might have been more important than tidal height in determining settlement rates. In a follow-up study we deployed individual PVC tees (n=45) that varied in tidal height and distance from bottom on a mudflat for one tide series. Both tidal height and distance from the bottom significantly affected spat settlement (Multiple regression, tidal height $p< 0.0001$, distance $p=0.0176$), with greatest settlement occurring on tees closest to the bottom at the lowest tidal heights. This implies that it would be more efficient to place settlement arrays at deeper tidal heights and closer to the bottom instead of hanging arrays off of docks.

30. ALGAL CONTROL BY PHOSPHATE RESTRICTION IN SHALLOW, FRESHWATER LAKES

T.M. Magrann, S.G. Dunbar, PhD, and D. Boskovic, PhD. Marine Research Group, Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

Public lakes in Southern California often have high phosphate concentrations from the use of reclaimed water and from water fowl excrement. This produces favorable conditions for the cyanobacterium, *Microcystis*, which is known for secreting hepatotoxins (microcystin), a carcinogen that causes liver cancer in animals and humans. Mason Regional Park (Irvine, CA) has a public recreational lake with high levels of microcystin. It is located just one mile from Upper Newport Bay, an estuary for endangered birds, and there is potential danger from cross contamination. The standard treatment for lake algae is usually copper sulfate. However, under anaerobic conditions copper can dissociate, be consumed by fish, and accumulate in the food chain. Since the use of copper sulfate is restricted due to its toxicity, the only alternative has been the use of alum (aluminum), which binds with phosphate, but leaves a gelatinous precipitate that builds up in the lake. This study used new technology to remove phosphate from Mason Lake. The Blue Pro unit is a modified koi pond ionized sand filtration system which precipitates phosphate using ferric chloride, producing a non-toxic, iron-phosphate cake that can be disposed of in landfill. The pilot study resulted in a 96% reduction in PO_4 and a 94% decrease in algal cells after just one pass through the unit.

31. THE PHYTOREMEDIATION CAPACITY OF *BACCHARIS SALICIFOLIA* WITH RESPECT TO COPPER SEQUESTRATION

Cordale Johnson, John Thomlinson, and Connie Vadheim Roth. Cal State University Dominguez Hills, Department of Biology, Carson, CA, 90747.

Copper is an essential element that is needed naturally for the development of humans, animals and plants. When copper compounds are found at high levels in soluble forms, exposure can become deadly. Remediating copper contamination is a lengthy, expensive process that can easily escalate to millions of dollars. Research has shown that plants can be used to remove toxic compounds from soil, a process known as phytoremediation. *Baccharis salicifolia*, also known as mulefat, is a dioecious plant that belongs to the family Asteraceae. It is fast growing and naturally occurs on upland soils in the Los Angeles Basin. It is a natural bioaccumulator which can take up contaminants such as copper directly from the soil. The mechanism of phytoremediation by *B. salicifolia* has not yet been fully elucidated. There are various phytoremediation processes, but it is believed that *B. salicifolia* uses either phytoextraction or rhizofiltration. The aim of this study was to determine how *B. salicifolia* decreases the amount of copper concentration in the soil and what process of phytoremediation it follows. We measured leaf and root concentrations of copper in 12 plants (clone 1 females) at doses of 0.0, 2.7, 5.4, and 8.1 mg l^{-1}, using a High-Performance Liquid Chromatograph. Root concentration increased with dosage ($R^2 = 0.41$, $p = 0.02$) while leaf concentration was unchanged ($R^2 = 0.08$, $p = 0.41$), indicating that mulefat is sequestering copper in the roots not the leaves.

32. THE PRODUCTION OF ACOUSTIC SIGNALS IN THE HOUSE CRICKET ACHETA DOMESTICUS: MORPHOLOGICAL INFLUENCE ON CALLING SONGS.

D. Lim and S.E. Walker. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92831.

Male crickets produce species-specific calling songs to attract females and deter rival males. Songs are produced when the male closes its raised forewings, causing the plectrum to engage the file teeth, resonating the harp and mirror to produce sound. Song features may communicate phenotypic characteristics about the signaling male. We investigated the relationship between morphological characteristics and calling song features of male *Acheta domesticus* and determined if song features can be used to discriminate among individuals. We recorded and analyzed the songs of newly matured males from a laboratory culture of *A. domesticus*. Song characteristics were measured and pronotum width was measured to assess body size. Geometric morphometrics was used to describe the variation in the shape and size of structures on the forewings (harp and mirror) that produce the sound. We found significant variation among individuals in all but one song characteristic measured, indicating individual males can be discriminated statistically. Only one song characteristic, pulses per chirp, was related to body size and the relationship was dependent on temperature. We found significant directional asymmetry in the harp and mirror, with right wings having larger structures than left wings, and this asymmetry was related to the degree of frequency modulation occurring within a pulse. In addition, the shape of the resonating

structures on the forewing were correlated with the degree of frequency modulation in a single pulse. Thus, not only is the size of the resonating structure important but also its shape.

33. EFFECT OF EXOTIC ANNUAL GRASS REMOVAL ON THE RE-ESTABLISHMENT OF COMMON NATIVE OAK UNDERSTORY SPECIES ON SANTA CATALINA ISLAND, CA

Matthew P. Sutton and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

Studies on the regeneration of Island scrub oak (*Quercus pacifica*) have shown that competition with exotic annual grasses significantly reduces vigor of *Q. pacifica* seedlings. It is not known how the presence of these grasses affects recruitment of other native species within this community. We examined recruitment of oak understory species at five sites with dying *Q. pacifica* and evaluated two restoration methods, exotic annual grass removal and seed addition of eight common native oak understory species. This experiment tested the following two hypotheses: 1) Exotic annual grass removal increases percent cover and species richness of native oak understory species by increasing resource availability (soil moisture, soil nutrients, and light), and 2) sites receiving both herbicide treatment and seed addition of common native oak understory species will have an increased germination and survivorship of these species. Preliminary data support hypothesis 1 with respect to species richness: the herbicide-seeded treatment had a higher species richness ($\mu \pm$ SE: 2.00 ± 0.34) than control-seeded, herbicide-unseeded or control-unseeded treatments ($\mu \pm$ SE: 1.75 ± 0.71, 1.05 ± 0.67, and 1.05 ± 0.57 respectively). However, data do not indicate support of hypothesis 1 with respect to percent cover: control-seeded had a higher percent cover of native species ($\mu \pm$ SE: 6.61 ± 2.86) than herbicide-seeded, control-unseeded ($\mu =$), or herbicide-unseeded treatments ($\mu \pm$ SE: 2.42 ± 1.39, 3.82 ± 1.96, and 0.45 ± 0.23 respectively).

34. ARE ALL LARVAE CREATED EQUAL? LIPID VARIATION IN *KELLETIA KELLETII* LARVAE ACROSS THEIR GEOGRAPHIC RANGE.

S.L. Kelley and D.C. Zacherl. Southern California Ecosystems Research Program, California State University, Fullerton, Department of Biology, Fullerton, CA, 92831.

Larval condition is known to have latent effects on juvenile condition and success for many marine species. Many factors influence larval condition including food availability, environment, inter- or intraspecific interactions, and maternal yolk contribution. Previous studies have demonstrated that quantifying yolk serves as a good indicator of larval condition. We hypothesized that yolk provisions would vary across the reproductive season and geographic range of *Kelletia kelletii*, Kellet's whelk, a predatory gastropod that has recently extended its range into colder waters across a biogeographic boundary at Point Conception. In summer 2005, fifteen larvae each from fifty-four broods were sampled from three sites each in the northern, southern, and Channel Islands regions. Fluorescent stain Nile red was used to stain lipids and measure lipid to shell-area ratios. Six broods per site were used to assess larval condition per region and to track changes over a reproductive season for one southern site, Palos Verdes. There was no significant difference in lipid/shell-area between early and late-season broods (nested ANOVA, $p=0.432$), though variation among broods within seasons was highly significant ($p<0.0001$). There was no significant difference in lipid/shell-area among regions (nested ANOVA, $p = 0.059$), however, with only three sites per region, power was low and variation was again high among broods within sites ($p<0.0001$). Larvae from the northern region averaged higher lipid/shell-area than the Channel Islands. Adding more sites within regions may reveal regional differences in larval condition. Future studies will investigate whether variation in yolk provisioning produces larvae with enhanced juvenile performance.

35. OUT OF THE SAND AND INTO THE SURF: DETERMINING PHILOPATRY AND POPULATION CONECTIVITY IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS* (ATHERINOPSIDAE).

A.W. Fredell and D.C. Zacherl. California State University Fullerton, Fullerton, CA, 92834.

The free swimming larval stage produced by many marine organisms has the potential to disperse long distances via ocean currents before recruiting to adult populations. However, recent research has

documented the possibility that a substantial portion of some marine larvae recruit back to their birth location. Whether this level of self recruitment occurs in populations over a large scale has implications for the management of marine populations, including culturally and economically important species such as the California grunion, *Leuresthes tenuis* a popular recreational fishery in southern California, which relies upon sandy beaches as critical spawning habitat. Our research attempts to understand the connectivity of spatially separated populations of California grunion using otolith natal tags. We first tested whether embryonic grunion otoliths from sites and/or regions within southern California varied spatially and temporally in their elemental composition. Grunion embryos were collected at 14 beaches within the southern California Bight on summer 2008, and from three of those beaches during two separate spawning events. Fifteen otoliths from each beach/spawning run were analyzed by laser-ablation inductively-coupled mass spectrometry. Grunion natal tags varied significantly among multiple regions in southern California as determined by MANOVA ($p<0.001$) and depicted in CDA plots (classification success 87%). Natal tags showed temporal variability among spawning events. The spatial variation in otolith tags will allow us to collect young-of-year grunion in 2009 from a subset of beaches, track those individuals back to their natal regions, and estimate the level of philopatry and grunion population connectivity.

36. COMPARISON OF TWO URBAN WETLAND SITES USING BENTHIC MACRO-INVERTEBRATES AND ABIOTIC VARIABLES

D.A. Anaya and John R. Thomlinson. California State University, Dominguez Hills, Department of Biology, Carson, CA, 90747.

Small wetlands are vital because they can harbor large numbers of species and are important ecologically. We considered the influence of water quality on benthic macroinvertebrates by comparing taxon richness and abiotic variables at Madrona Marsh Preserve, a restored wetland site in Torrance and Gardena Willows Wetland Preserve, a remnant site in Gardena. In May 2008 we found high taxon richness at two locations at each site in a pilot study, but a full study at 12 locations at each of the two sites in January 2009 gave very different results. The taxon richness was low, with at most three taxa at a location, and we observed similar taxon richness within and between the sites. Principal components analysis suggested that low water quality at both wetland sites was responsible for the low taxon richness and extreme dominance of the samples by Oligochaetes. However, there was no significant relationship between benthic macro invertebrates and abiotic variables since taxon richness was so low. This study indicates the extreme seasonal macroinvertebrate community variation in these small, isolated wetlands. It is possible that Oligochaetes dominate at the peak of the wet season, and that as the wetlands dry out, other taxa are able to compete for resources. Alternatively, our findings in January 2009 might result from a specific hydrologic event. Further studies will try to elucidate the actual dynamics of these systems.

37. THE EFFECTS OF LIGHT AND FEEDING CYCLES ON FEEDING ANTICIPATORY BEHAVIORS OF THE BAY PIPEFISH, *SYNGNATHUS LEPTORHYNCHUS*

K. Bayley, H. Chu, and M. Estrada. University of California Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90024.

Feeding anticipatory behaviors are common in fish based on the availability of food and the amount of light. This experiment examines the effects of light and feeding periods on the anticipatory feeding behaviors of the Bay Pipefish, *Syngnathus leptorhynchus*. One hundred twenty pipefish were divided into four tanks with different light and feeding cycles. Their behaviors were recorded and analyzed every hour. Data analysis suggests that there is a statistical difference in feeding anticipatory activities between tanks with different feeding cycles, but no statistical difference between tanks with different light cycles. Feeding anticipatory activities may allow the pipefish to optimally forage for food while using the least amount of energy.

38. CORRELATION BETWEEN FREQUENCY OF MARINE LEECH (*MALMIANA BUTHI*) INFECTION AND THE SIZE OF ITS FISH HOST (*OLIGOCOTTUS SNYDERI*)

Noelle Bidegainberry, Alison Fujii, and Larisa Pender-Healy. Dept. of Ecology and Evolutionary Biology, UCLA.

Malmiana buthi is a recently described marine leech that is the only leech species found in the intertidal zone in North America. Its primary fish host is the Fluffy Sculpin, *Oligocottius snyderi*. A few studies have found a positive correlation between host size and parasite load involving leeches. To examine this possible relationship in this host-parasite pair, we quantified the leeches parasitizing 195 specimens of *O. snyderi* that were collected from the tidepools of Horseshoe Cove on the Bodega Marine Reserve in Bodega Bay, California. We found no significant correlation ($R^2 = 0.1928$, $P = 0.37$) between the standard length of the host specimens and the quantity of leeches on them. However, there was a highly significant difference ($P < 0.0001$) between the larger and smaller halves of the host sample in terms of leech prevalence. Thus, like some other leeches, larger *O. snyderi* are more likely to be infected with leeches but the larger host specimens do not necessarily have more leeches.

39. COMBINED GEOCHEMICAL AND DIGENETIC PROCESSES CONTROL THE CADMIUM ENRICHEMENT IN SEDIMENTARY ROCKS OF SOUTHERN TOGO, WEST AFRICA

REZAIE BOROON M.H. California State University, Los Angeles, CA, mrezaie@calstatela.edu. . **RAMIREZ P.** California State University, Los Angeles, CA, pramir@calstatela.edu. **GNANDI K.** University of Lome, Togo, kgnandi@yahoo.fr.

The analysis of the sedimentary phosphorite of the southern Togo indicates deposition in a productive upwelling system present during lower to middle Eocene. The upwelling system was similar to that generating phosphorites of the Monterey Formation and related rocks of California. Samples retrieved from an actively mined phosphate-enriched layer varying from 1 to 10s of meters in thickness consist mostly of moderately to poorly sorted phosphatized pellets, foraminifera, and other bioclastic debris. Attapulgite clay occurs interstitially. The presence of attapulgite clay and the enrichment in chemically immobile elements P_2O_5, CaO and TiO2 in the phosphorites suggest intensive chemical weathering of the source rocks under tropical and humid climatic conditions. Comparatively, the Togo phosphorites are enriched in Cd three times more than averages for similar world deposits and 157 times more than global shale averages. Francolite is the main mineral phase present in the samples. Geochemically, the rocks show significant enrichment in P_2O_5 and CaO. Mean oxide compositions (wt %) are 31.27% P_2O_5, 43.74% CaO, 9.50% SiO_2, 4.30% Al_2O_3, 2.96% Fe_2O_3, 0.11% K_2O, 0.19% TiO_2, 0.02% MnO, 0.02% MgO, 0.02% Na_2O, and 6.12% LOI (loss of ignition). Our analysis shows that Cd, U, Th, and F are incorporated into the francolite. As with some of the Miocene pelletal/oolitic phosphatic rocks of California, the Togo phophorites likely represent sediment accumulated beneath fertile oceanic waters followed by phosphatization resulting in high phosphorous contents and elevated Cd and Cu concentrations

40. DEVELOPMENT OF THE HEART AND QUANTIFICATION OF SPONGY VERSUS COMPACT MYOCARDIUM IN ENDOTHERMIC AND ECTOTHERMIC SCOMBRID FISHES

Doreen Emilee Carpio, Lori Critchfield, and Kathryn Dickson. California State University of Fullerton, Department of Biological Science; Fullerton, CA 92831.

Tunas maintain temperature of certain tissues above ambient water temperature (regional endothermy). Tunas also swim continuously and have high metabolic rates. Compared with other fishes, adult tunas have larger hearts and a higher percentage of compact myocardium, allowing their hearts to pump large volumes of blood at high pressures. Our objective is to compare heart size and structure in juveniles of two tuna species, yellowfin (*Thunnus albacares*) and black skipjack (*Euthynnus lineatus*), and a related ectothermic scombrid, the sierra mackerel (*Scomberomorus sierra*). We hypothesized that heart mass will increase with size in juveniles of all three species, and that relative heart mass and percentage of compact myocardium will be greater in tunas. Hearts were extracted from formalin-fixed juvenile yellowfin tuna (n=14; 31–65 mm), black skipjack tuna (n=16; 46–274 mm), and sierra mackerel (n=20; 44–214 mm), and heart mass and total fish mass were measured. Hearts were embedded in paraffin, sectioned, stained, and digitally photographed, and the percentage cross-sectional area of compact and spongy myocardia were quantified using Scion Image analysis software. Heart mass did increase with fish size in all three species, and relative heart mass was greater in black skipjack tuna than in sierra mackerel. Also, the black skipjack tuna had a higher percentage of compact myocardium than the sierra mackerel. Myocardium

measurements for the yellowfin tuna are in progress. Thus, like adults, juvenile tuna have a higher percentage of compact myocardium and larger hearts than related ectothermic species.

41. INTROGRESSION OF MITOCHONDRIAL DNA BETWEEN *CATOSTOMUS FUMEIVENTRIS* AND *CATOSTOMUS SANTAANAE* (CYPRINIFORMES: CATOSTOMIDAE) IN THE SANTA CLARA DRAINAGE

Chris Chabot[1], Donald Buth[1], Camm Swift[2], Jonathan Sim[1], Thomas Dowling[3], and Larry Allen[4]. [1]UCLA, Los Angeles, CA; [2]Entrix, Inc., Ventura, CA; [3]Arizona State University, Tempe, AZ; [4]California State University, Northridge, CA.

Our previous allozyme study confirmed the presence of "pure" parentals, and both F_1 and F_2 hybrids between *Catostomus fumeiventris* and *C. santaanae* in the Santa Clara drainage in southern California where both species were introduced many decades ago. To obtain further information, sequences were obtained from a mitochondrial gene (subunit 2 of the NADH dehyrdrogenase [ND2]) for 156 of the 160 specimens used in the allozymic identification. We found ND2 sequences of both *C. fumeiventris* and *C. santaanae* present among both of the F_1 and F_2 groups as well as in both of the "pure" parental species. Introgression is bidirectional but biased as 6% of "pure" *C. santaanae* and 50% of "pure" *C. fumeiventris* express mtDNA of opposite species. The Santa Clara populations are genetically compromised and caution should be exercised if one uses these introduced populations as a source of research specimens in place of those from their native (protected) ranges

42. A COMPARISON OF CURRENT AND HISTORICAL SHOREBIRD POPULATIONS IN VENTURA COUNTY: PRELIMINARY RESULTS

Angela Chapman, Donald A. Rodriguez, Christopher Kahler, Christina Fahim, Lisa Winfrey, and Amanda Goldstein. Biology and Environmental Science and Resource Management Programs, One University Drive, California State University Channel Islands, Camarillo, CA 93012.

The status of shorebird populations serves as a measure of the health of coastal communities and potentially as an indicator of human disturbances (such as oil spills, harassment from domestic animals or recreational activities, and beach construction). The primary goal of this study is to continue the development of a long term data set of coastal bird observations in an effort to quantitatively investigate and characterize shorebird species and their seasonal populations along the Ventura County coastline. Fourteen one-kilometer transects, covering 20% of the Ventura shoreline adjacent to offshore oil and gas operations are being monitored monthly for three years. Preliminary results, comprising 18 months of data, are compared to a similar three year study completed from 1994–1997. For the six most common species, numbers remain consistent with the findings from the 1994–1997 study. There is high degree of inter-year variation. The coefficient of variation for the six most common species is high (0.63–1.81) as it was for the previous study (0.72–1.61). The number of bird observations per kilometer, when compared to the previous study, is very similar for sanderlings (19.2 versus 20.6), is higher for marbled godwits (4.4 versus 2.9), snowy plovers (2.12 versus 1.9) and whimbrels (3.37 versus 1.3) and lower for willets (9.4 versus 14.0) and black-bellied plovers (0.79 versus 2.2). The final data set will enable management agencies to perform rigorous analyses on any potential effects of offshore operations on the sensitive coastal shorebirds that inhabit the region.

43. A STING TO DIE FOR: RELATIONSHIP BETWEEN VENOM AVAILABILITY AND PREDATORY AND DEFENSIVE STINGING BEHAVIOR IN THE CENTIPEDES *SCOLOPENDRA POLYMORPHA* AND *S. SUBSPINIPES*

A.M. Cooper, G.A. Fox, D.R. Nelsen, and W.K. Hayes. Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

We conducted several studies to examine venom yield and venom use in the scolopendrid centipedes *Scolopendra polymorpha* (southwest North America) and *S. subspinipes* (Asia). Using electric-stimulation

extraction ("milking"), we found a significant correlation between centipede length and total volume of venom extracted ($r_s^2 = 0.75$). Mean protein concentration was similar for the two species (120 μg/μL) and did not vary among the first three electrically-induced venom pulses, suggesting absence of "prevenom". For predatory stings, centipedes were fed a live cricket (*Acheta domesticus*) either before ("unmilked" condition) or after ("milked" condition) venom extraction in a repeated-measures design. Crickets attacked by unmilked centipedes became immobilized significantly faster than crickets attacked by milked centipedes, even though milked centipedes delivered significantly more stings. The significant correlation between number of stings and time to immobilization in the milked condition suggests that centipedes delivered more stings to longer-struggling prey. To elicit defensive stings, plastic-encased cotton targets were thrust at *S. polymorpha* that were unrestrained (low-threat condition) or restrained by noose (high-threat condition) in a repeated-measures design. Restrained centipedes were significantly more likely to sting the target than unrestrained centipedes (100% versus 27%), but the majority (93%) of 28 presentations eliciting stings resulted in dry stings. The two "wet" stings yielded 0.50 and 0.64 μL venom (60 and 77 μg protein), representing 28 and 30% of the venom electrically extracted from the individual centipedes. Collectively, these findings provide a foundation for further investigations into the behavioral ecology of sting and venom use in centipedes.

44. HOW DANGEROUS ARE BABY RATTLESNAKES? ORIGIN AND PREVALENCE OF A DEFANGED MYTH

A.G. Corbit and W.K. Hayes. Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA, 92350.

The myth that baby rattlesnakes are more dangerous than adults has persisted despite all evidence to the contrary. A key reason often cited for the greater danger is that baby rattlesnakes cannot control how much venom they inject and dispense all of their venom supply when biting, thereby delivering more venom than adults that can control venom expenditure. We examined historical newspaper records and surveyed colleges across the country to explore the origin of this myth and its prevalence. From 49 newspaper stories located, we determined that 1) all stories prior to 1969 were factually correct regardless of location; 2) factually incorrect statements first appeared in California during the period 1970–1999; and factually incorrect statements prevailed throughout the U.S. after 2000. Surveys of 3692 students at 52 colleges and 1 high school from among 29 states showed highest prevalence of familiarity with the myth in the western states (southwest = 53%, northwest = 49%), intermediate familiarity in southcentral (37%) and southeastern (31%) states, and least familiarity in northcentral (23%) and northeastern (16%) states. We conclude that the myth originated in California sometime during or prior to the 1970s and is now widely believed by millions throughout the United States. Surveys among southern California health professionals indicated a much higher familiarity and belief in the myth than that observed in college students. Unfortunately, belief in this myth can lead to negative consequences, including misinformed risk-taking by those encountering snakes, unwarranted fear among snakebite victims, and inappropriate care delivered by medical professionals.

45. STORMWATER PLUME DEVELOPMENT IN SANTA MONICA BAY, CA

A.A. Corcoran, K.M. Reifel, B.H. Jones, and R.F. Shipe. Department of Ecology and Evolutionary Biology, University of California Los Angeles, Los Angeles, CA 90095; Marine Environmental Biology, Department of Biological Sciences, University of Southern California, Los Angeles, CA 90089; Institute of the Environment, University of California Los Angeles, Los Angeles, CA 90095.

This study characterized stormwater plume evolution through shipboard monitoring in Santa Monica Bay, California, a coastal system that is subject to rapid pulses of untreated runoff from the urbanized watershed of Los Angeles during the winter rainy season. The physical, chemical, and biological signatures of stormwater plumes were tracked over time after each of 2 precipitation events in January 2008. Low salinity surface plumes persisted in Santa Monica Bay for at least 2 to 5 days over spatial scales of up to 15 km. This is consistent with a 6-day residence time for surface water plume parcels, which was estimated from a drifter trajectory in the bay. Shipboard sampling and salinity measurements in the surf zone

showed that plumes often persisted nearshore. Plume waters were generally characterized by increased dissolved nitrogen, colored dissolved organic matter, and light attenuation. Rain events led to increases in phytoplankton biomass, and specifically, increases in diatom biomass, as measured by concentrations of biogenic silica. We suggest that as regulations of stormwater runoff are developed in the region they incorporate dissolved nutrients in addition to conventional parameters such as toxins and metals.

46. MICROCLIMATE TRENDS FOR THREE SPECIES OF COASTAL SAGE SCRUB ON THE PALOS VERDES PENINSULA.

A. Dalkey[1], N. Lim[1], O. Saliu[2], and N. Wakama[2]. [1]Palos Verdes Peninsula Land Conservancy, Rolling Hills Estates, CA, 90274; [2]Palos Verdes Peninsula High School, Rolling Hills Estates, CA 90274.

Can differences in microclimate on a 1 m to 1 km scale be detected and related to plant distribution? And, if so, can the information be helpful for coastal sage scrub restoration projects? These two questions were explored at the mid-point of a year-long effort that started in November 2008. Small data loggers were deployed at various locations to monitor temperature, relative humidity, and dew point for three coastal sage species: *Encelia californica*, *Opuntia littoralis*, and *Salvia leucophylla*. Also, parameters for slope, aspect, and elevation were considered along with soil type. Information gained from the data loggers showed similar trends. Unusual events, such as an upper-level fogbank, could be detected.

47. AGGREGATING BEHAVIOR AND SPECIES PREFERENCE IN THREE SPECIES OF GUNNEL: *APODICHTHYS FLAVIDUS*, *APODICHTHYS FUCORUM* AND *PHOLIS ORNATE*.

T. Duong, J. Gov, and G. Liu. UCLA, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

The ability to camouflage and hide is crucial in the rocky intertidal; color polymorphism dictates the spatial distribution of gunnels, leading to similar color morphs aggregating together. We intend to study this behavior by observing and describing aggregations of gunnels in addition to determining whether aggregations are conspecific or nonspecific in three species in the family Pholidae: *Apodichthys flavidus* (Penpoint Gunnel), *Apodichthys fucorum* (Rockweed Gunnel) and *Pholis ornata* (Saddleback Gunnel). Our results indicate significant aggregating behavior in all species that may be due to predator-avoidance mechanisms, but more interestingly, we found that none of the test species had any species-specific preferences. This suggests that the mere presence of another individual is sufficiently beneficial and overrides possible species-specific preferences.

48. COMPARISON OF DIGESTIVE ENZYME ACTIVITIES IN THE ENDOTHERMIC MAKO SHARK AND THE ECTOTHERMIC BLUE SHARK

Ali Forghani, Ramtin Khanipour, and Kathryn Dickson. California State University of Fullerton, Department of Biological Science; Fullerton, CA 92831.

Lamnid sharks, including the shortfin mako (*Isurus oxyrinchus*), maintain elevated digestive tract temperatures by conserving metabolic heat produced by digestion and assimilation using the suprahepatic *rete*, a vascular counter-current heat exchanger (visceral endothermy). The purpose of this research project is to test the hypothesis that visceral endothermy results in higher digestive enzyme activities in lamnid sharks, by comparing the mako to the ectothermic blue shark (*Prionace glauca*). Activities of two protease enzymes, pepsin and trypsin, were measured in the digestive tracts of mako shark and blue shark at 15–25°C so that we could compare activities at *in vivo* temperatures. In the mako shark, stomach pepsin activity was significantly greater at 25°C than at 15°C. Pancreatic trypsin activity was significantly higher at 25°C than at 20°C for both mako and blue sharks. At the elevated visceral temperature of the mako (25°C), both pepsin and trypsin activities were significantly greater than in the blue shark at its lower *in vivo* temperature. This study provides evidence that increasing digestive enzyme activity may be an advantage of elevating digestive tract temperatures in the endothermic mako shark.

49. VENOM YIELD AND CHARACTERISTICS IN THE DESERT HAIRY SCORPION (HADRURUS ARIZONENSIS)

G.A. Fox, W.K. Hayes, A.M. Cooper, and D.R. Nelsen. Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA, 92350.

The desert hairy scorpion (*Hadrurus arizonensis*) is the largest scorpion in the United States, yet it has been relatively understudied. To begin investigation of the behavioral ecology of its venom, we examined the effect of electrical milking procedures on venom volume and venom yield in relation to body size. We tested the hypothesis that successive milkings could be obtained without a concomitant decrease in venom volume and protein concentration. Twenty-eight specimens ranging in size from 81.2–111.8 mm total length were milked five times over three week intervals. Both the volume of venom extracted (ANOVA, $P = 0.95$) and its protein concentration (mean +/− SD = 27.2 +/− 5.4 μg/μl) remained unchanged during the five milking sessions. Similar to other venomous animals (e.g., snakes), the amount of venom extracted was exponentially related to scorpion body length (exponential regression, $P < 0.001$, r-squared = 0.53). During venom extractions, we noted that the initial secretion to emerge was clear followed by much larger quantities of opalescent secretion. This observation suggests that *H. arizonensis* produces potassium-rich "pre-venom" in addition to protein-rich "venom," as described previously for the African buthid scorpion, *Parabuthus transvaalicus*. When grasped by the metasoma (tail) or telson (stinger), *H. arizonensis* specimens sometimes expulsed venom in a weak stream somewhat resembling the more forceful squirts of *P. transvaalicus*. Thus, some of the unique behaviors of African buthid scorpions may be shared by large vaejovid scorpions of the American southwest.

50. TEMPORAL TRENDS IN SOUTHERN CALIFORNIA SURF FISH POPULATIONS

H.L. Gliniak, C.F. Valle, E.T. Jarvis, O. Horning, and C. Linardich. California Department of Fish and Game, Los Alamitos, CA 90720.

Despite the predominance of sandy beaches in southern California that support several important sport fishes, few studies exist describing the fish fauna in this shallow surf zone environment. We investigated the size and abundance of fishes in this area in relation to seasonal, yearly, and decadal changes by conducting monthly beach seine hauls at four sites within the Southern California Bight from June 2007 to February 2009. We used similar gear and methods to studies conducted in the 1950s and 1990s. A total of 293 hauls captured 22,500 fish comprising 44 species. The fish community was dominated by juvenile to adult silversides, croakers, and surfperches. Abundances of most fishes fluctuated seasonally. In general, silversides were more abundant in the fall, croakers were more abundant in the spring-summer, and surfperches were equally abundant throughout the year. Fish abundances showed little change from 2007 to 2009. However, abundances of yellowfin croaker (*Umbrina roncador*), spotfin croaker (*Roncador stearnsii*), barred surfperch (*Amphistichus argenteus*), walleye surfperch (*Hyperprosopon argenteum*), and leopard shark (*Triakis semifasciata*) increased in 2007–09 relative to the 1990s; yellowfin croaker and leopard shark were also much more abundant in the current study than in the 1950s. Barred surfperch showed the greatest decline in abundance from the 1950s to 2007–09, falling from rank 3 to 10. These changes may be due to several factors including habitat modifications, regulations, oceanographic changes, and overfishing.

51. TOLERANCE INTERVALS OF BIOINDICATORS CHARACTERIZE REFERENCE CONDITIONS FOR SOFT BOTTOM MACROFAUNA OFF SAN DIEGO, SOUTHERN CALIFORNIA

Nick Haring, Tim Stebbins, and Ron Velarde. City of San Diego Marine Biology Laboratory, Metropolitan Wastewater Department, San Diego, CA 92101.

A clear understanding of natural or background conditions is critical to successful environmental monitoring studies. Characterization of such conditions using tolerance intervals of relevant indicator metrics can a) define what is natural and help establish appropriate baselines, b) aid in distinguishing reference from impacted sites, and c) provide a level of statistical certainty when comparing impacted to

reference conditions. The City of San Diego has conducted annual surveys along the continental shelf and slope off San Diego since 1994 to characterize environmental conditions for this diverse coastal region. Classification analysis of 324 different sites sampled over a 10 year period identified 156 sites as representative habitat surrounding the City's Point Loma Ocean Outfall (PLOO) monitoring area. Consequently, data from these sites were used to calculate reference tolerance intervals for 12 environmental indicators. These indicators included abundances of three pollution sensitive and three pollution tolerant taxa, species richness, total macrofaunal abundance, Shannon diversity (H'), Pielou's evenness (J'), Swartz dominance, and the benthic response index (BRI). The resultant tolerance interval bounds provided a robust and accurate assessment of reference conditions for comparison to potential impacts associated with wastewater discharge from the PLOO. Additionally, tolerance interval calculations can be used in conjunction with other statistically rigorous methods of impact detection (e.g., BACI analyses) to provide a broader context to those data. Lastly, the tolerance intervals calculated for the San Diego region should be updated over time to incorporate spatio-temporal changes that may affect the bounds of reference conditions surrounding the PLOO.

52. SPATIAL AND TEMPORAL ANALYSIS OF BARRED SAND BASS CATCH IN THE SOUTHERN CALIFORNIA PRIVATE/RENTAL BOAT FISHERY (2004–2008)

O. Horning, E.T. Jarvis, and C.F. Valle. California Department of Fish and Game, Marine Region, Los Alamitos, CA, 90720.

In the summer, barred sand bass (*Paralabrax nebulifer*) form large breeding aggregations which have been targeted in the southern California recreational fishery for decades. Catch location data from the California Recreational Fishery Survey (CRFS) for private and rental boats (2004–2008) were analyzed with a Geographic Information System (GIS). The objectives of this study were to identify the major "hotspot" catch locations (potential spawning grounds) throughout the Southern California Bight (SCB) and to identify temporal and spatial trends of catch on a finer scale at a historical aggregation site (Huntington Beach Flats). GIS analysis identified five "hotspot" catch locations throughout the SCB. Of these, locations off Huntington Beach and San Diego annually showed the highest proportion of barred sand bass catch. Fishing areas off Orange County showed a higher proportion of the catch per area in the summer months (47.4%) whereas San Diego County showed a higher proportion of catch per area in the winter months (61.3%). On a local scale, we found significant differences in the proportion of barred sand bass catch across five different fishing locations within the San Pedro shelf by season (early, peak, late, and non-spawning). These data are valuable for future studies on spawning-related movements of barred sand bass and provide information for the development of a fishery management plan for this species.

53. DISTRIBUTION AND ABUNDANCE OF JUVENILE *POCILLOPORA SP.* AND ENCRUSTING CORALLINE ALGAE ON OCEANOGRAPHIC MOORINGS AROUND MOOREA, FRENCH POLYNESIA

A.K. James. Moorea LTER, University of California Santa Barbara, Department of Ecology Evolution and Marine Biology, Santa Barbara, CA, 93117.

Observational studies of the distribution of juvenile coral species recruiting to oceanographic moorings were conducted on the fore reefs of Moorea, French Polynesia to provide insight into potential drivers of these patterns. Juvenile *Pocillopora sp.* were surveyed using cylindrical instruments deployed on lines throughout the water column. Six study sites around the island were utilized to map the abundance and size of these juveniles as a function of depth. Subsequent measurements of major benthic space holders (encrusting coralline algae, species of red and brown algae, bare space, and other organisms) were recorded to provide further insight into the patterns observed. These data revealed a strong tendency of corals to congregate in a "mid" depth range (10–15 m), being less common in the shallow (5–10 m) and deep (15–20 m) depth ranges. Size data revealed that the majority of small corals (0–100 mm^2) were found in the mid depth range and that larger corals (>100 mm^2) are absent below 15 m. Although many factors may impact the frequency and size distribution of corals, higher levels of coral larval flux within different depth ranges, cues from conspecifics, post-settlement mortality, corallivore feeding, and

interspecific competition can greatly impact the settlement and survival of juvenile corals in this area. Further studies are needed to establish the causes of the distributions seen.

54. TO SPECIATE OR NOT TO SPECIATE?: POPULATION STRUCTURE OF *HAMINOEA VESICULA* (OPISTHOBRANCHIA: HAMINOEIDAE) IN THE NORTHEAST PACIFIC

Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032.

Two separate populations of *Haminoea vesicula* (Gould, 1855) are assessed based on complete specimens and shells collected primarily in British Columbia, Canada and Southern California, United States with the purpose of determining whether there are significant differences between them to justify a speciation event for this species.

Specimens are compared using morphological and genetic characteristics. Evaluation of diagnostically reliable features including the external morphology, radulae, and gizzard plates through SEM micrographs, camera lucida, and digital photography revealed consistent differences that support a divergence between the two populations which may culminate in speciation. The shell morphology and male copulatory organs present no variations. Mitochondrial genetic markers (partial 16S fragments) offer promising additional data to test morphological differences. Protocols for DNA extraction and sequencing of long-term preserved tissue will be used to compare the two populations once more material from northern populations becomes available.

With the presented data it is clear that the two populations show consistent variation suggesting the possibility of divergence. However, further investigation and corroboration of differences is needed before sufficient evidence is compiled to support the establishment of a new name for the northern population. Determination of the population structure of *Haminoea vesicula* or the possibility of the existence of a second, cryptic species in the northern part of the range is of the utmost importance in further understanding the biology of this species. This knowledge will contribute to understanding the influence of environmental change on this species through factors such as global warming.

55. THE IMPACT OF FIGHTING STRESS ON LIFESPAN IN THE HOUSE CRICKET (*ACHETA DOMESTICUS*)

W. Liu, C. Mac, and S.E. Walker. Department of Biological Science, California State University Fullerton, Fullerton CA 92831.

Intraspecific male competition is common in many animal species. Previous studies have shown that male-male competition has costs in terms of energy and stress. While fighting, male crickets expend a great deal of energy and risk physical injury in rare cases. We hypothesized that male house crickets, *Acheta domesticus*, with higher frequency of fighting would expend more energy and be more stressed; thus, the crickets with higher fighting frequency should have shorter lifespans than those crickets that do not fight as often. We observed male crickets and manipulated their frequency of fighting, which ranged from a control condition (no fights) to a high frequency of fighting (four fights) with 24 hour periods in between each consecutive fight, and then measured their lifespan. The results from a preliminary analysis of data showed that the more fights the crickets engaged in, the shorter they lived. This indicates that, like other costs of reproduction (e.g. mating), aggressive interactions among males influence lifespan which is an important fitness component in species that can mate multiple times over their lifetime.

56. DO WOODY CHAPARRAL SPECIES FACILITATE RECRUITMENT OF ISLAND OAKS ON CATALINA ISLAND?

Miguel A. Macias, Matthew P. Sutton, and Darren R. Sandquist. California State University, Fullerton, Department of Biological Science, Fullerton, CA, 92834-6850.

Island scrub oak (*Quercus pacifica*), a native tree of Catalina Island, is in decline primarily due to low seedling recruitment. Previous studies indicate that woody species often facilitate oak recruitment. This

study tested the hypothesis that emergence, vigor, and survivorship of *Q. pacifica* are greater at the canopy edge of Lemonade berry (*Rhus intergrifolia*) and Toyon (*Heteromeles arbutifolia*) than in the open. In December 2008, acorns were planted at five plots in each canopy edge type (*R. intergrifolia*, *H. arbutifolia*, and open); plots consisted of 30 planting sites (4 acorns per site). Monthly measurements were taken of seedlings emergence, height, stem diameter, numbers of leaves, and leaf chlorophyll content. Preliminary analyses have shown some patterns that contradict those predicted. In particular, emergence of *Q. pacifica* was greatest in the open (32.2% ± 4.2) than under *R. intergrifolia* (9.7% ± 0.9) or *H. arbutifolia* (22.3% ± 2.4). Vigor was also greater for emerged seedlings in the open than for those near the canopy edge or *H. arbutifolia* or *R. intergrifolia*. These results suggest that oak recruitment on Santa Catalina Island may be less dependent on overstory nurse plants than in other oak systems.

57. ENVIRONMENTAL METAPHORS IN SCIENCE AND SOCIETY: WORKFLOW OF THE CASE STUDY "THE ELEPHANT AND THE OAK TREE"

V.G. Minnich. University of California, Santa Barbara. Donald Bren School of Environmental Science and Management. Santa Barbara, CA, 93106.

The Elephant and the Oak Tree (EOT) is a first case study of formulating and applying a "media ecology" approach, or adaptive and integrative workflow of storytelling and audience feedback in concern of environmental metaphors in science and society. EOT was constructed in order to explore and address these two major questions: "How does one make the pursuit of science and environmental problem solving more accessible and inspirational to the broader public?" and "How does one convince scientists and diverse stakeholders to adopt a more integrative approach in feedbacks between collective learning and behavioral change? (e.g. science and policy)" Designing and engaging in this systematic workflow—from construction of multi-media narrative to dissemination and collective response—has the capacity to assimilate knowledge in the fields of (1) ecology, evolution, and earth sciences, (2) environmental institutions and the sociology of scientific practice, (3) cognitive layering/ sense-making of storytelling, and (4) public communications campaigns/ feedbacks between the storyteller and his or her audience. Feedback from specific audiences will be evaluated through surveys.

58. POSSIBLE ROLE OF KIDNEY CHROMAFFIN CELLS IN CRANIAL ENDOTHERMY IN THE ALBACORE TUNA, *THUNNUS ALALUNGA*

H. Musharbash and K.A. Dickson. Department of Biological Science, California State University, Fullerton, Fullerton, CA, 93831.

Most fish species, including the eastern Pacific bonito (*Sarda chiliensis*), are ectothermic, whereas the albacore tuna (*Thunnus alalunga*) is a regional endotherm that maintains the temperature of the aerobic locomotor muscle, the viscera, and the cranial region elevated above ambient water temperature. The carotid *retia*, vascular counter-current heat exchangers, retain heat within the cranial region, but the heat source for cranial endothermy in tunas is unknown. We hypothesized that chromaffin cells in the head kidney, which release the vasoactive chemicals norepinephrine and epinephrine, play a role in cranial endothermy in tunas by regulating cranial blood flow and heat exchange rate. We reasoned that, if chromaffin cells are involved in cranial endothermy, the amount of chromaffin cells present in the albacore tuna would be greater than that found in the eastern Pacific bonito. Head kidney tissue was dissected from heads of both species (n=3), stained for chromaffin cells using potassium dichromate and sodium sulfate, embedded in paraffin and sectioned. Scion image analysis software was used to calculate the relative area (percentage cross-sectional area) of chromaffin cells in head kidney tissue samples. Head kidney tissue of the albacore tuna contained 3.88 ± 1.08% (mean ± SD) chromaffin cells, while the bonito head kidney had 3.62 ± 0.88% chromaffin cells. These preliminary findings do not support a role for the chromaffin cells in cranial endothermy, but additional research will be conducted to quantify chromaffin cells and the catecholamines they contain in both species.

59. POKE BUT DON'T PINCH: RISK ASSESSMENT AND DEFENSIVE BEHAVIORS OF THE WESTERN WIDOW SPIDER (*LATRODECUTS HESPERUS*)

D.R. Nelsen, A.M. Cooper, G.A. Fox, and W.K. Hayes. Loma Linda University, Department of Earth and Biological Sciences, Loma Linda, CA, 92350.

We investigated defensive behaviors of the Western Widow Spider (*Latrodectus hesperus*), a medically relevant, synanthopic species found throughout western North America, including Southern California. To elicit defensive behaviors, wild-caught adult females (N = 43) were either prodded once (low threat), prodded repeatedly (medium threat), or pinched repeatedly (high threat) with gelatin "fingers" in a repeated measures design. We collected data on defensive behaviors that were non-aggressive (retracting limb(s), fleeing, playing dead) and aggressive (silk flicking, biting). The proportion of spiders whose first response to provocation was non-aggressive was 100% across all threat levels. Besides flight, the most common defensive behavior elicited in low, medium, and high threat conditions was retraction (16%), silk flicking (56%), and biting (59%), respectively. Spiders were significantly more likely to bite ($p<.0001$) "fingers" when pinched (59%) than when prodded singly (0%) or repeatedly (2%). Number of bites delivered (mean +/− SD) was significantly greater for pinched (2.7 +/− 3.6) than repeatedly prodded (0.02 +/− 0.15) spiders. Spiders were significantly more likely to flick silk at fingers when pinched (43%) or prodded repeatedly (56%) than when prodded singly (5%). Number of silk flicks was also significantly greater for pinched (1.8 +/− 2.9) and repeatedly prodded (3.7 +/− 5.5) than for singly prodded (0.05 +/− 0.21) spiders. This study concludes that *L. hesperus* are first non-aggressive, but if compressed between two object will bite defensively. This helps to confirm the idea that the Western Widow Spider is generally non-aggressive.

60. ECOLOGY OF AN INTERTIDAL LEECH: EXPANDING THE RANGE OF *MALMIANA BUTHI*

J.C. Notar and J. Gessow. University of California, Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

The intertidal leech *Malmiana buthi* has only been known to parasitize fish in one location, the northern end of Horseshoe Cove, Sonoma County, California. *M. buthi* has been found solely to parasitize sculpins (Cottidae) and its primary host is the Fluffy Sculpin (*Oligocottus snyderi*). Sculpins are known to inhabit tidepools along the North American Pacific Coast and it is therefore hypothesized that the range of *M. buthi* extends beyond their one known location. Sculpins were collected by hand from five locations, ranging from Dillon Beach, Marin County, the most southern point, to Pebble Beach at "Sea Ranch", Sonoma County, the most northern point. Leeches were found to parasitize sculpins at every location surveyed. This confirms that the range is wider than previously described, and is likely to extend much farther along the coast.

61. AERIAL THERMAL IMAGERY AND PLANT DIVERSITY IN POST-FIRE ENVIRONMENTS OF THE NORTH MOUNTAIN EXPERIMENTAL AREA

Mark E. Parlow, Marcia G. Narog, Jan L. Beyers, David R. Weise, Philip J. Riggan, and Anna Wrona. USDA Forest Service, Riverside, California, 92507.

During 2006, the Esperanza fire burned 17,000 ha (42,000 acres) on North Mountain Experimental Area, Riverside County, CA. Here, previous fires created a mosaic of vegetation age classes from 1 to over 100 years. For this paper we examined post-fire plant diversity based on seed bank germination from two soil depths (0–2.5 and 2.5–5.0 cm) collected at sites randomly chosen from thermal images showing variable fire intensities during the Esperanza fire. At each site 10 soil samples were collected then placed in a greenhouse in (25 × 50 cm) flats containing sterile soil and watered for 6.5 months. Seedlings to mature plants were identified and counted. Eighty species were identified from 12,000 plants that germinated. At 0–2.5 cm high moderate and low intensity burn areas produced species means of 6.1 species 5.4 and 5.1 respectively. Samples at 2.5–5 cm showed no trend with regard to intensity and species means: high 5.4, moderate 5.7, low 5.1. Among age classes, species diversity was greatest (mean of 10 species per site) in young stands ($\leq$ 10 years) compared to 4.5 at 11–49 years and 5.8 for $\geq$ 50 years. High intensity and frequently burned areas produced more species in the upper soil profile than seeds exposed to moderate or low intensity in less frequently burned deeper soil. Further analysis on species composition will be performed to determine if native or alien species responded differently to thermal image fire intensities. More research needs to be conducted to refine methodology for predicting resource recovery from aerial thermal imagery.

62. THE USE OF ROTENONE AS MEANS OF INCREASING SURVEY BIODIVERSITY IN THE ROCKY INTERTIDAL ZONE

C.R. Pospisil, Rene Carbajal, and Suong Tran. Department of Ecology and Evolutionary Biology, UCLA, Los Angeles CA, 90095-1606.

Quantitative and qualitative measurements of biodiversity are critical in evaluating and understanding the long-term standings and inner workings of aquatic ecosystems. In our study, we compare biodiversity indices between surveys conducted with rotenone and surveys conducted without rotenone in three tide pools to evaluate the selectivity of different sampling methods in the rocky intertidal. The indices used in this study were the Index of Similarity and the Simpson's Index. Despite limited available data, our results indicate that rotenone may provide surveyors with more consistent and unbiased collections of fishes than would otherwise be possible than dip netting without rotenone.

63. AN HERBARIUM STUDY OF THE PHENOLOGY OF FOUR WET-SEASON DECIDUOUS TROPICAL PLANT SPECIES

J. Quintanilla, L. Gabrielian, and V. Carmona-Galindo. Department of Biology, Loyola Marymount University, Los Angeles, CA 90045.

The phenology, or the timing of expansion or abscission of leaves, flowers, and fruit in tropical trees is not well understood. Most deciduous plant species in the seasonal tropics are dry-season deciduous, shedding leaves during the early dry-season. There are some plant species in dry forests that exhibit a reverse phenology, shedding leaves during the wet-season rather than the dry-season. We used specimen-sheet information from online herbaria to study the leaf, flower and fruit phenologies of four wet-season deciduous plant species: *Bonellia nervosa* (Theophrastaceae), *Cocoloba liebmanni* (Polygonaceae), *Faidherbia albida* (Fabaceae), and *Forchameria pallida* (Capparaceae). We queried approximately 10 online herbaria (both national and international institutions), which resulted in a low sample sizes from the single African species (*F. albida*, n=8) and higher sample sizes from the remaining Mesoamerican species (overall, n≥38). Additionally, the sample size of *B. nervosa* (n=176) allowed us to evaluate the latitudinal trends of leaves, fruit, and flower phenologies. This study emphasizes that (1) specimen databases from online herbaria are an important resource for studying plant phenologies, and (2) greater collaboration between national and international institutions is needed to promote the growth of online resources in the study of biological phenomena.

64. DO MEDICAGO TRUNCATULA SEEDS PERCEIVE NOD FACTOR?

N.R. Rahman, G. Ramírez, and G. Brelles-Mariño. California State Polytechnic University, Biological Sciences Department, 3801 W. Temple Ave., Pomona, CA 91768.

Legumes are able to symbiotically interact with soil bacteria known as rhizobia, forming specialized structures called **nodules** which are the site for nitrogen fixation. The rhizobia-legume symbiosis provides the plant with ammonia, a product of the reduction of atmospheric N_2, which is incorporated into plant metabolism. This symbiotic interaction implies an ecologically friendly way of fertilizing crops and remediating nitrogen depleted soils. In the presence of a compatible plant root, rhizobia produce signal molecules called Nod factors (NFs) that trigger developmental responses in the plant that lead to better nodulation and nitrogen fixation. The mechanism for NF perception is poorly understood. Research has exclusively focused on the perception of these factors by roots. For the symbiotic pair *Medicago truncatula-Sinorhizobium meliloti* it has been reported that *Medicago* seed treatment prior to symbiont inoculation yield a significant increase in nodule number. The objective of our work is to study a putative NF perception by *M. truncatula* seeds. Initial experiments were carried out using transgenic *M. truncatula* seeds carrying the p*MtENOD11-gusA* gene fusion. The seeds were exposed to a 10^{-8} M Nod Factor suspension and processed for *gus* staining with a 15-minute vacuum infiltration and further overnight incubation. Following the staining procedure, seeds were sectioned and subjected to microscopy analysis. The expression of *ENOD11* genes results in blue color. Preliminary results have revealed *ENOD11* gene

expression in seed tissue, mostly in cortical cells, suggesting the presence of a NF perception system. Further investigations are being carried out to confirm these results.

65. EVIDENCE FOR SIMILAR CLIMATIC CONDITIONS DURING DEPOSITION OF THE PALEOCENE SILVERADO AND LAS VIRGENES FORMATIONS OF SOUTHERN CALIFORNIA AND THE EOCENE IONE FORMATION OF CENTRAL CALIFORNIA

P.C. Ramirez and A.C. Hamane. Department of Geological Sciences, California State University, Los Angeles Los Angeles, CA 90032.

Sandstones in the Paleocene Silverado Formation of the San Joaquin and Santa Ana Mountains, in the Paleocene Las Virgenes Sandstone of the Santa Monica Mountains, and in the Eocene Ione Formation exposed along the western margins of the Sierra Nevada Mountains in central California represent in part deposition in high energy fluvial systems under similar climatic conditions. The sandstones, which consist of varying proportions of mostly quartz and feldspar, were largely derived from a granitic source. In places, the sandstones include intensely weathered and altered zones dominated by quartz floating in a kaolinite matrix. Quartz grains are etched and embayed. The matrix originated through kaolinization of feldspars and other labile constituents. Iron nodules also occur in some altered zones. Dissolution and kaolinization of grains and the occurrence of iron nodules represent extreme chemical weathering likely associated with the development of Oxisols during tropical to subtropical climates. Kaolinite rip-up clasts present in sandstones suggest additional paleosols formed and were subsequently eroded away. Consequently, Paleocene rocks of the Silverado and Las Virgenes Sandstone in southern California and Eocene rocks of the Ione Formation record periods of warmer and wetter climate. Ocean temperatures, which influence global climates, show rapid increases during the late Paleocene and early Eocene. The development of the paleosols may be related to these global temperature increases.

66. AN INVESTIGATION OF THE MECHANISM OF METHOXYCHLOR IMPACT ON THE DEVELOPMENT OF THYMOCYTES.

Sergio Sandoval. University of La Verne Biology Department, 1950 Third St. La Verne, CA 91750.

Endocrine-disrupting chemicals interfere with the normal function of the endocrine system, causing reproductive problems. Recent research within this field has reveled that endocrine disruptors may potentially cause negative impacts in the immune system, specifically in immune system development. The aim of this study is to investigate the mechanism of action of Methoxychlor (MXC), an endocrine disruptor. To address the mechanism of action of MXC, an in vitro assay was used to examine the development of T cells extracted from C57BL/6 mice embryos of 16–18 days gestation in the presence or absence of MXC. Doses of 12.5 μM, 25 μM, and 50 μM of MXC were used; cells were treated for 18–20 hours and stained with Annexin V FITC and PI to determine possible apoptotic cells and to differentiate necrotic cells. Our results suggest that MXC may be causing apoptosis at higher concentrations of 25 μM and 50 μM. These results give us insight into a possible mechanism of EDC action and can be used to develop a cost-effective method to determine toxicity of EDC's. Having an in vitro assay that tests for immunotoxicity will provide more information on EDC's to the public and potentially reduce exposure.

67. DISTRIBUTION OF MYLITUS AND PISASTER AT THE LOS ANGELES RIVER OUTLET

S.R. Scoma, L.C. Teague, A.M. Noice, and M. Moradian. Pasadena City College, Pasadena, 91101.

At the Los Angeles River outlet at the Port of L.A. in Long Beach (CA), the distribution of *Mylitus edulis* and *Pisaster ochraceus* forms 3 distinct patterns within one kilometer: 1) *Mylitus* only, 2) *Pisaster* and *Mylitus*, 3) Piaster only. The *Mylitus*-only zone is farther up river and has the most variable salinity throughout the year while the *Pisaster*-only zone has salinity most like the open ocean. In the *Pisaster*-only zone the *Mylitus* are replaced by red algal turfs and Bryazoans. We suspected that competition, salinity

tolerance, and/or predation were the possible causes of the pattern we found. We began to investigate the causes of this unusual pattern by doing reciprocal transplants of bryazoans and *Mylitus* from the extremes of the zonation. We found that Bryazoans transplanted up river to the *Mytitus*-only zone all died within 2 weeks. At the other extreme the *Mylitus* transplanted to the Bryazoan-only zone were all eaten within one week by the *Pisaster*. It seems from our preliminary data that *Pisaster* is controlling the distribution of *Mylitus* at the mouth of the river seaward while the salinity is controlling the Bryazoan distribution up river.

68. EFFECTS OF DELAYED HATCHING ON DEVELOPMENT AND SWIMMING SPEED IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*

Treybig, Trally, Degrassi, Allyson, Casillas, Ernesto, Hessom, Elizabeth, and Ramos, Elaine.

The California grunion, *Leuresthes tenuis*, spawns on shore during spring high tides, and fertilized eggs incubate 9–14 days until wave action stimulates hatching during the next spring high tide series. Embryos that are not washed out can remain viable for 35–50 days and may hatch during subsequent spring high tides. We hypothesized that larvae fertilized at two different times and hatched simultaneously would differ in developmental state and swimming speed. We monitored environmental conditions that grunion embryos experience on three beaches in southern California. Egg masses were located, their depths and tidal heights were measured, and sand movements and temperature at two depths (15 and 25 cm) were monitored at each beach for 32 h during a spring tide series. Mean sand temperature at depths where we found grunion egg masses ranged from 17.5°C to 23.7°C. Temperature fluctuated by as much as 11.4°C and varied more at shallower depths. These differences in temperature will affect the rate of grunion embryonic development and when they are ready to hatch. Based on measured tidal heights of the egg masses, predicted tides and sand movements within the environment, embryos may be forced to delay hatching. To assess the effects of delayed hatching in the *L. tenius* about the measured development and swimming speed in 30-days-post-fertilization (dpf) larvae and 14-dpf larvae. The 30-dpf larvae were significantly longer, had less yolk, and fewer myotomes than the 14-dpf larvae, but swimming speed did not differ between the two groups. Delayed hatching resulted in larger, more developed larvae with reduced energy reserves, and these characteristics may impact post-hatching survival in *Leuresthes tenuis*.

69. THE DISTRIBUTION AND BEHAVIOR OF THE INTERTIDAL LEECH *MALMIANA BUTHI* AS OBSERVED IN THE ROCKFISH TANK AT THE BODEGA MARINE LABORATORY

Ashleigh Berger, David Lau, **Christina Truong**. Department of Ecology and Evolutionary Biology, University of California, Los Angeles, 90024.

There is only one known species of intertidal marine leech, *Malmiana buthi. M. buthi* is a small leech growing only up to 8 mm in length. It has an oral sucker up to 0.4 mm in diameter and a caudal sucker up to 1.0 mm in diameter (Burreson and Kalman, 2006). The only known range of the leech was Northern Horseshoe Cove in Bodega Bay, California. Little has been observed about the behavior and distributions of these parasites in accordance with the behavior and distributions of their hosts. Observations of the leech behavior and distributions on hosts as well as vertical zonation were obtained by monitoring the glass rockfish tank at the Bodega Marine Laboratory. The tank measured approximately 380 cm × 280 cm × 170 cm and contained specimens of the genus *Sebastes*. Species of this genus included *caurinus*, *melanops*, *nebulosus*, *chrysomelas*, *carnatus*, *flavidus*, and *rastrelliger*. We have found that the highest leech and rockfish activity was observed between 13:15 and 18:15 while the lowest was observed between 01:15 and 06:15. We found correlation between leeches and rockfish based on their prevalence in the upper and lower zones of the tank and that leeches preferred the pectoral fins. Though these observations were made from an artificial environment, we still have gained some insight on the behavior of the little studied intertidal marine leech, *Malmiana buthi*.

70. TEMPERATURE REQUIREMENTS FOR GERMINATION OF THE SAND VERBENAS *ABRONIA MARITIMA* S. AND *ABRONIA UMBELLATA* LAM.

Kristine Tulio and Philippa M. Drennan. Loyola Marymount University, Department of Biology, Los Angeles, CA 90045.

The coastal sand verbenas *Abronia maritima* and *Abronia umbellata* differ in their habitat and distribution in California. *Abronia maritima* is restricted to coastal dunes and does not occur north of Morro Bay. *Abronia umbellata* is found in both dunes and scrub throughout California reaching its northern limit at Puget Sound in Washington. Both species are negatively photoblastic but germinate in the light in the presence of ethephon (100 μmol l^{-1}). With ethephon, germination of *A. maritima* is greatest over the range of 15 to 25 °C, decreases above 30 °C, and is strongly inhibited at 10 and 40 °C. For *A. umbellata* under the same conditions, maximum germination occurs in the range of 20 to 25 °C, and decreases above 30 °C and below 15 °C. However, while germination is inhibited at 40 °C, approximately 50% germination occurs at 10 °C. In the dark and without ethephon, *A. maritima* requires alternating temperatures for germination (15/35 °C), but germination of *A. umbellata* is greatest at a constant temperature of 20 °C and significantly reduced by alternating temperatures. Differences in temperature response are consistent with the distribution range and habitats of these species. Sand temperatures monitored continuously for a year in the Ballona dunes show temperatures suitable for germination of *A. umbellata* during winter months and especially associated with rainfall events which decrease temperature fluctuations. Overgrowth of open sand by other species, especially invasive grasses, alters the temperature of the soil decreasing the fluctuations required for the germination of *A. maritima*.

71. IDENTIFYING CULTURABLE BACTERIA FROM DEL REY LAGOON, LOS ANGELES COUNTY, DURING FLOOD AND EBB TIDAL FLOWS

Jennifer T. Valdez[1], Julie Huh[2], and John H. Dorsey[3]. [1]Loyola Marymount University, Department of Civil Engineering, Los Angeles, CA 90045; [2]Marlborough School, Los Angeles, CA 90004; [3]Loyola Marymount University, Natural Science Department, Los Angeles, CA 90045.

Del Rey Lagoon is a small coastal embayment of 5.3 acres located in Playa Del Rey, Los Angeles, and is suspected as being a source of fecal indicator bacteria (FIB: total coliforms and *E. coli*, and enterococci) outwelling into the adjacent Ballona Creek Estuary. Culturable bacteria were identified as part of a study describing the flux of fecal indicator between the lagoon and estuary during ebb- and flood-flow tidal periods. During six sampling events during 2008–09, ebb- and flood-flow densities for the two FIB groups (n=3 replicates samples/FIB group) were determined using Colilert-18 defined-substrate media for total coliforms and *E. coli*, and Enterolert media for enterococci, with samples partitioned in 97-well Quantitrays (Idexx Laboratories, Inc., Westbrook, Maine). From each set of tidal replicates per FIB group, 10 Quantitray wells testing positive for FIB were randomly selected with 3 μl of each plated onto a series of nutrient agar to isolate species. Isolates then were identified using the Vitek 2 Compact microbiological identification system (bioMerieux, Inc., Durham, North Carolina).

To date, approximately 40 species of culturable bacteria have been identified from the Idexx wells. Common groups included species of *enterobacteriacea*, *enterococcaceae vibrionaceae*, and *staphylococcaceae*. Species of *Vibrio*, including *V. cholerae*, were common during warmer summer-early fall months. Diversity analyses (e.g. Sorensen, Bray-Curtis) suggested that flood-flows from the estuary were more diverse that water ebbing from the lagoon.

72. SEXUAL DIMORPHISM IN HOUSE CRICKETS (*ACHETA DOMESTICUS*) AND *GRYLLUS PENNSYLVANICUS*

B.D. Narcisse[1], **K. Vuong**[1], J. Andrew Roberts[2], and S.E. Walker[1]. [1]Department of Biological Science, California State University Fullerton, Department of Biology, Fullerton, CA, 92831; [2]Department of Evolution, Ecology, and Organismal Biology, The Ohio State University at Newark, Newark OH, 43055.

Competition among males has been exhibited throughout history over resources, territories, and of course, the opposite sex. Competition among males for the possession of females to gain reproductive success has been seen across a number of animal taxa. In some species sex differences in appearance are associated with differences in the way males and females obtain higher fitness. Males obtain greater fitness by mating repeatedly whereas females obtain greater fitness by laying a large number of eggs. Males use visual displays of their mandibles while fighting and we hypothesized that male heads would be larger than female heads. However, because the size of the abdomen can potentially limit the number of eggs a female has, we predicted

that abdomen size would be greater in females than in males. We evaluated this by examining sex differences in the morphology of two species of cricket, *Acheta domesticus* and *Gryllus pennsylvanicus*. There was a significant difference in head size and abdomen size in males and females of both species. The males were generally smaller, but have a significantly larger head size as compared to the females of the same species. In addition, females have significantly larger abdomens than males. These data suggest that there are differential selection pressure acting on the males and females that is potentially dependent on their reproductive role.

73. THE EFFECTS OF AGE AND STRESS ON THE IMMUNE RESPONSE OF MALE AND FEMALE HOUSE CRICKETS (*ACHETA DOMESTICUS*)

K. Celeste, E. Hill, and **S.E. Walker**. Department of Biological Science, California State University Fullerton, Fullerton, CA, 92831.

Differences among the sexes are prevalent in a number of characteristics (e.g. size, behavior) and males and females can respond differently to stress. In the present study, we examined the encapsulation response, a measure of the immune response to a foreign body, of male and female house crickets (*Acheta domesticus*) as a function of age as well as in response to stress.

To measure encapsulation, each cricket was anesthetized and a small puncture was made at the abdomen where a 2–3 mm piece of clear monofilament line was inserted. After 6 hours, the monofilament line was removed and photographed. A higher degree of encapsulation results in a darker monofilament line. We used Imagej to quantify the average gray value. Virgin male and female crickets were used in all experiments. To examine the impact of age, we used crickets that were 1week post-adult molt and crickets that were 5 weeks post-adult molt. Younger females had a higher encapsulation rate than young males and older females. However, there was no change in encapsulation rate for males. To evaluate the impacts of stress on the immune response we used 2–3 weeks post-adult molt virgin male and female crickets. Crickets were stressed by withholding water for four days. This causes a substantial loss of mass (approximately10% of initial body mass) but does not cause mortality. We found no effect of water stress on the cricket's encapsulation response.

74. OCULAR MUSCLES AS A HEAT SOURCE FOR CRANIAL ENDOTHERMY IN THE SHORTFIN MAKO SHARK, *ISURUS OXYRINCHUS*

N.P. West and K.A. Dickson. California State University Fullerton, Department of Biological Science, Fullerton, CA, 92831.

Lamnid sharks can elevate the temperature of the eye and brain above ambient water temperature. Heat produced by the contraction of the slow-twitch, aerobic swimming muscle is transported to the cranial region via the red muscle vein. Previous studies have noted that the ocular muscles of lamnid sharks are larger and darker in color than those of ectothermic sharks and suggested that aerobic metabolism in these muscles may contribute to heat production needed to maintain elevated cranial temperatures. We hypothesized that the ocular muscles of the endothermic shortfin mako shark, *Isurus oxyrinchus*, do contribute to cranial endothermy and thus would have a greater aerobic metabolic capacity than those of the ectothermic blue shark, *Prionace glauca*. We compared the activity of the enzyme citrate synthase (CS), an index of aerobic metabolic capacity and mitochondrial density, in all six ocular muscles of mako and blue sharks. No significant differences were found between the proximal and distal portions of the ocular muscles in both the blue ($p=0.300$) and mako ($p=0.099$) sharks. Only one ocular muscle, the medial rectus, had significantly higher CS activity in the mako shark than in the blue shark ($p=0.028$), but CS activities were low compared with other fish aerobic muscles. Thus, we found limited evidence that ocular muscle contraction contributes to heat production for cranial endothermy in the shortfin mako shark. Heat produced by contraction of the medial rectus muscle, in addition to heat transferred from the warm aerobic locomotor muscle, would be conserved within the suborbital *rete* to elevate eye and brain temperatures.

75. EFFECTS OF RECENT FIRE ON PLANT DIVERSITY ALONG CHAPARRAL FUEL BREAKS

Anna M. Wrona, Marcia G. Narog, Tim Paysen, and Jan L. Beyers. USDA Forest Service Pacific Southwest Research Station, Riverside, California, 92507.

Chaparral-covered North Mountain Experimental Area in Riverside County, California has experienced repeated fires over the past 100 years. In the 1950s, a network of fuel breaks was constructed and sporadically maintained; most became colonized by herbaceous species and sub-shrubs. Many of the herbaceous species are non-native grasses and forbs that have the potential to invade chaparral after disturbance such as frequent fire. We evaluated how the 2006, 40,000 acre (16,100 ha) Esperanza fire affected vegetation re-growth and development in fuel breaks and bordering chaparral edges. Plant diversity and cover were measured within fuel breaks and adjacent chaparral that burned in the Esperanza fire and areas that escaped the fire. Thirty transects were placed along 2 miles of 3 stretches of dirt roads, each 50 m long with seven 1-m^2 plots. Seventeen transects were in burned areas, and 13 were unburned. We identified 68 native and non-native species in 2007 and 64 in 2008. Both years had 1 tree, 8 shrub and 7 sub-shrub species; the rest were forbs and grasses. Both burned and unburned plots had higher species richness on fuel break plots compared to plots 40 m into the chaparral. The Esperanza fire did not appear to increase the number of non-native species invading chaparral. However, non-native cover was higher within the chaparral edge of recently burned areas compared to unburned edges, indicating fire does influence invasion into chaparral stands. Trends of non-native vegetation between plots with varied fire history prior to Esperanza will also be discussed.

76. INORGANIC SEDIMENT SOURCE, FLUX, AND COMPOSITION WITHIN BAYS IN ST. JOHN, U.S. VIRGIN ISLANDS

Kimbrie L. Gobbi, Patricia V. Narwold, and Sarah C. Gray. University of San Diego, Marine Science and Environmental Studies Department, 5998 Alcala Park, San Diego, CA 92110.

Increased terrigenous runoff associated with development is one of the most serious threats to coral reefs. Data presented here is the first in a series of studies to evaluate whether development on St John, US Virgin Islands impacts the quantity, quality, and spatial variability of sedimentation. Bay-floor sediment composition, texture, and substrate cover is compared to data from surveys 20 years prior and total and compositional sediment flux rates are compared in reefs and bays below developed and undeveloped watersheds. Bay-floor sediments were dominated by $CaCO_3$ (43–93%), then terrigenous (6–55%), and finally organics (2–8%). The predominant texture was sand (mean 868 μm) with coarser particles (> 50% gravel) associated with reefs. For each of eight sediment-trap sampling periods of approximately 13 days over the rainy season, unsieved sediment flux rates were 2 −133 times higher on the reefs below developed watersheds vs. undeveloped watersheds. Developed watershed sediment flux rates (4–950 $mgcm^{-2}\ d^{-1}$) were sometimes within ranges that cause severe to catastrophic stress to corals. The proportionate increase in sediment flux with a major rainfall event was greater at the developed than the undeveloped bay (storm/baseline flux rate = 342 vs. 5). $CaCO_3$ was the most abundant sediment constituent at all sampling sites except those nearest the shore in the developed bay. Terrigenous flux rates were 34× higher (18 vs. 0.5 $mgcm^{-2}\ d^{-1}$) on reefs below the developed watershed. Detailed monitoring of sedimentological processes affecting individual reefs is critical for ecological monitoring and necessary to evaluate effectiveness of erosion mitigation strategies.

below the developed watershed. Detailed monitoring of sedimentological processes affecting individual reefs is critical for ecological monitoring and necessary to evaluate effectiveness of erosion mitigation strategies.

77. EVIDENCE OF REDUCED GENE FLOW ALONG AN INSHORE-OFFSHORE GRADIENT OBSERVED IN KELP BASS (*PARALABRAX CLATHRATUS*) IN THE SOUTHERN CALIFORNIA BIGHT

S.M. Trbovich and R.R. Wilson, Jr. California State University-Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Published studies suggest that recruiting kelp bass (*Paralabrax clathratus*) inhabiting the northern Channel Islands are genetically distinguishable between the eastern and western regions of the Santa Barbara Channel. This is potentially due to differing current and thermal regimes between the regions, which extend to eastern and western regions of the overall Southern California Bight (SCB). To evaluate a generalized hypothesis of an east-west (inshore-offshore) genetic gradient for kelp bass across the SCB, we

sampled adult kelp bass along an east-west transect line represented principally by 54 samples taken from San Nicolas Island (SNI) and 50 from Santa Catalina Island (SCAI). We genotyped all samples at five polymorphic microsatellite loci reported in an earlier study. Average heterozygosity was lower at SNI than at SCAI for four microsatellite loci (average difference of $H_O = 0.09$) and there was a lower allele richness at the most polymorphic locus (20 alleles at SCAI versus 14 at SNI). An allele-by-allele comparison between the two sample sets revealed a substantial proportion of private alleles at multiple loci and significant overall pairwise frequency differences (Fisher's Exact Test, $p = 0.008$). Genetic differentiation at microsatellite loci (Jost's $D=0.222$, $\Delta_{ST}=1.169$) and coalescent analysis using MIGRATE also indicates a low generational rate of genetic exchange between SNI and SCAI. Coupled with the reduced genetic diversity and allelic richness, these results suggest that kelp bass at SNI are recruiting from a reduced larval pool and/or episodic recruitment events as compared to SCAI.

78. 9:20 BOOM AND BUST IN SOUTHERN CALIFORNIA KELP BEDS

Michael D. Curtis. Senior Scientist MBC Applied Environmental Sciences Costa Mesa, CA.

Sporadically over the past century and consistently over the last four decades, more than 50 distinct kelp beds have been monitored from Ventura to the Mexican Border by means of aerial infrared kelp bed canopy mapping frequently enough for us to develop a regional perspective on persistence of kelp beds. From these data, insight is provided of the kelp beds response to and the aftermath of the limits to growth of our kelp beds.

This record documents that kelp beds in southern California (where nutrients are only sporadically available) respond unfavorably to El Niños and recover during La Niñas. These cyclical environmental perturbations depict a boom and bust affect on our kelp beds. Although the persistence of an individual bed may be dependent on many variables, naturally occurring environmental perturbations such as temperature regimes (dependent on manifestations of El Niños and La Niñas in the short term and Interdecadal Oscillations on a longer term) and the implications for nutrient availability, control most of the variability observed in southern California kelp beds. Some other natural events such as large scale storms (are these natural still?), sediment deposition, persistent phytoplankton blooms (another question?), and anthropogenic influences such as wastewater discharges, erosion, and predator-prey imbalances brought on by overfishing affect individual beds or in some cases a portion of the region. Because of these factors, there is a tendency to blame the anthropogenic factors on the persistence of giant kelp beds in general. These factors were probably far more compelling in the past than during the last four decades. By looking at the long-term record dating back to Crandall's original giant kelp maps of 1912, we have a baseline to explore the persistence of the kelp beds of southern California. Although information is sketchy for the first half century of the 1900s, enough is available to definitively document large changes in the giant kelp beds that were probably caused by anthropogenic influences. These losses would include whole kelp beds that have disappeared from the coast and not seen since the 1920s and 1930s such as the Sunset Kelp Bed, the Dago Bank Kelp Bed (Horseshoe Kelp), Huntington Flats Kelp Bed, Doheny Kelp Bed, and long-term losses of kelp beds such as Palos Verdes, and the Imperial Beach Kelp Beds, as well as the reduction in size of numerous other kelp beds along the southern California coast. But the shorter term losses of the Newport Coast, Laguna Beach, San Mateo, San Onofre, and Barn kelp beds can be directly attributed to El Niños and the devastating storms that appear to accompany them as well as indirect factors such as the inundation of once available habitat as appears to be the case at Sunset, Newport Coast, San Onofre, Santa Margarita, and the Mexican Border. When correlating kelp canopy coverage to El Niños and La Niñas for the region over this period, it becomes immediately apparent that most of the variability can be explained by these large scale perturbations.

Although water quality problems have mostly abated, the increasing frequency of El Niños over the past 25 years, which may be related to the more overarching problem of climate change, could mean the loss of our kelp and their entire ecosystem for 15 to 25 years or more such as occurred in the past at Palos Verdes Peninsula (loss of kelp for 15 years), Newport Beach Coast (no kelp for 25 years), Laguna Beach (no kelp for 14 years), and Imperial Beach (loss of kelp for 7 years). It is feasible to intervene and effect successful recoveries of these kelp beds when a total loss is attributable to an El Niño has been demonstrated at Palos Verdes in the 1970s and more recently in the Newport Coast and Laguna Beach area. It is also a testament to the environmental push in the 1970s and the regulatory agencies birth that we have observed major

recoveries from anthropogenic influences with kelp beds at Salt Creek/Dana Point larger than seen in over a half century and at Imperial Beach larger than in over a century.

79. A TEST FOR CORRELATED RECRUITMENT OF PREDATOR AND PREY SPECIES OF KELP FOREST FISHES

J.M. Krug. and M.A. Steele. California State University, Northridge, Department of Biology, Northridge, CA, 91330.

Many marine fishes have a pelagic larval stage whose transport is driven by oceanographic processes, such as currents. Shared exposure of larvae to these processes seems likely to cause recruitment of demersal fishes to be spatially correlated. Correlations in recruitment of predators and prey could significantly affect prey population dynamics. We tested for correlations between the main predator kelp bass (*Paralabrax clathratus*) and eight species of fishes at Santa Catalina Island, California. Recruits were counted seven times from June to December 2008 along twenty-seven 30-m^3 transects at each of eight sites spread over about 30 km along the north coast of Catalina. Adults were counted four times along similar transects. Density and canopy cover of giant kelp, *Macrocystis pyrifera*, as well as substrate cover was quantified along transects at each site. Recruitment was correlated for some species at some times, but not all. Recruitment of two abundant prey species was negatively correlated with densities of young-of-year kelp bass. Sites with high recruitment of kelp bass also had high densities of adult kelp bass. Various habitat attributes, such as *Macrocystis* canopy cover, density of *Macrocystis*, and percent cover of large boulders, are correlated with recruitment of some species. The observed patterns of recruitment imply that shared exposure to ocean currents may not lead to correlated recruitment for many species.

80. BOTTOM-UP FORCING AND VARIATION IN THE SOUTHERN CALIFORNIA GIANT KELP FORESTS, 1967–2007.

Eric F. Miller. MBC Applied Environmental Sciences, Costa Mesa, CA.

Giant kelp (*Macrocystis pyrifera*) beds are a prominent feature of the Orange and San Diego Counties' coastline, providing significant habitat for various marine species. These beds have been monitored annually since at least 1967, forming one of the most extensive and coherent time series of marine community dynamics. Kelp bed dynamics has fluctuated widely over this time, exhibiting impacts of storms, ENSO/La Niña cycles, and anthropogenic effects. Recent research has suggested variances in the Channel Islands' annual kelp bed size are largely regulated by top-down factors, such as targeted fishing of upper trophic level predators. These conclusions were tested using the more extensive Orange County and San Diego Counties' coastline dataset as well as accessory datasets documenting abundance trends in other components of the kelp forest ecosystem.

81. THE ROCKY REEFS OF THE SOUTHERN CALIFORNIA BIGHT

D.J. Pondella, II. Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041.

As part of SCCWRP's Bight '08 project, 25 local, state and federal agencies, universities and NGOs and consulting groups are participating an assessment of the rocky reefs of the Southern California Bight. The first goal of this program was to document the distribution of hard bottom habitats inside the 30 m isobath throughout the bight. This was accomplished using all available data layers in GIS. Rocky reef maps were then reviewed by regional reef experts. All reefs were demarcated and classified by habitat type (major reef complex, patchy reef, cobble, offshore or pinnacle reef, artificial). We also included oil rigs in this project. There are approximately 48,982 hectares of rocky reef in the bight, occupying about 25% of the nearshore habitat within the 30 m isobath. Using the CRANE surveys of 2003–04, four biogeographic provinces were found in the bight (Oregonian Islands, Oregonian Mainland, San Diegan Islands, San Diegan Mainland). Of the 137 identified reefs in the bight, 60 were selected using a stratified random design and evenly distributed among the four biogeographic regions. We surveyed all reefs using CRANE

methods. This presentation will update the preliminary findings of the most intensive survey of reefs in the Southern California Bight.

82. THE ICHTHYOPLANKTON OF KING HARBOR, REDONDO BEACH, CALIFORNIA, 1974–2006

D.J. Pondella, II[1], J.P. Williams[1], and E.F. Miller[2]. [1]Department of Biology and Vantuna Research Group, Moore Laboratory of Zoology, Occidental College, 1600 Campus Rd. Los Angeles, CA 90041; [2]MBC Applied Environmental Sciences, 3000 Red Hill Ave., Costa Mesa, CA 92626.

The Vantuna Research Group has been monitoring the ichthyoplankton of King Harbor, Redondo Beach on a monthly basis continually since 1974. In the southern California bight, this is the only long-term monitoring program of this nearshore larval fish assemblage. Over this time series, the larval community significantly changed. There were three major annual groupings of fish larvae: 1974–1977, 1978–1994 and 1995–2006. The larval assemblage of King Harbor was not returning to the pre-1978 condition, instead it continued to move on a trajectory away from the cold phase of the PDO. Macro scale oceanographic processes (ENSO, PDO, Southern California Bight SST) were not significant factors in the change in larval densities over time. The major factor in the change over time was a long-term decline in larval catch. This change was a factor of declining nearshore productivity. Larval catch was statistically similar between the VRG King Harbor study and the Redondo Beach Generating Station's entrainment characterization survey. Using change among years in larval density as a factor, a minimum three year interval would be necessary to describe the change in this larval community.

83. 15 YEARS OF PLATFORM FISH RESEARCH SOMEHOW REDUCED TO A 15 MINUTE SOUNDBITE

M.S. Love and M. Nishimoto. Marine Science Institute, University of California, Santa Barbara, 93106. D. S. Schroeder, Minerals Management Service, 770 Paseo Camarillo, CA 93010.

We have surveyed the fish assemblages of southern California oil and gas platforms since 1990. In general, the shallow portions of the platform structure (jacket) are dominated by nearshore reef fish species and by young-of-the-year rockfishes (genus *Sebastes*). The sea floor-platform jacket habitat is primarily occupied by sub-adult and adult fishes, again primarily rockfish species. The shell mounds surrounding platforms serve as habitat for dwarf fish species, such as rockfishes and lingcod (*Ophiodon elongatus*). Platforms tend to harbor higher densities of young rockfishes than do natural reefs, probably because pelagic juvenile rockfishes are more likely to encounter the platforms' greater vertical relief. Similar to natural reefs, platforms both produce and attract fishes. Recent research demonstrates that fishes living near platforms do not have higher levels of heavy metals than do those inhabiting natural sites.

84. HABITAT FORMING INVERTEBRATES ASSOCIATED WITH OIL PLATFORMS IN THE SANTA BARBARA CHANNEL: POSSIBLE ALTERNATIVE STABLE STATES

H.M. Page, J.E. Dugan, C.S. Culver, and S.C. Schroeter. Marine Science Institute, University of California, Santa Barbara, CA, 93117.

In this talk, we briefly review the characteristics of the shallow water platform invertebrate assemblage and explore the possibility that alternative stable states can occur. Two species of mussels, *Mytilus californianus* and *M. galloprovincialis* have traditionally been the dominant space holding taxa at water depths of <15 m on oil platforms in the Santa Barbara Channel (SBC). Mussel clumps provide three dimensional biotic habitat for other sessile and mobile species. Observations and data indicate that mussels are a predictable and stable space-holding dominant, having been reported on platforms for 30+ years, and capable of re-colonizing platforms over time if removed through human or natural disturbance. However, a photographic survey of seven platforms in the SBC in 2001 revealed the presence on one of them of a potential "alternative" assemblage dominant, the non-indigenous bryozoan *Watersipora tubtorquata*,

which co-occurred with the mussel community in patches with high cover and several centimeters thickness. Our observations suggest that on this platform, disturbance of the existing assemblage may not necessarily lead to an assemblage dominated by mussels, but to one dominated by *Watersipora*. Timing of disturbance relative to the availability of mussel and bryozoan propagules may determine the trajectory of assemblage development. A qualitative re-survey of one platform in 2008 that lacked *Watersipora* in 2001 revealed the bryozoan on areas that had been cleaned, suggesting the possibility that it is expanding in distribution. The existence of an alternative stable state could have implications for platform ecology and human uses of the invertebrate assemblage.

85. SITE FIDELITY PATTERNS OF GROUNDFISHES ASSOCIATED WITH PLATFORMS IN THE SANTA BARBARA CHANNEL.

C.G. Lowe[1], K.M. Anthony[1], E.T. Jarvis[1], L.F. Bellquist.[1], and M.S. Love[2]. [1]California State University Long Beach, Dept. of Biological Sciences, Long Beach, CA 90840; [2]Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA 93106.

In order to better assess the ecological importance of offshore petroleum platforms for economically important groundfishes, we quantified the degree of site fidelity of 100 platform-associated individuals, representing 15 species at three offshore platforms in the Santa Barbara Channel using acoustic telemetry monitoring. Degrees of site fidelity varied widely among individuals, among species, and between platforms. Of the most abundant species tagged (cabezon, *Scorpaenichthys marmoratus*; vermilion, *Sebastes miniatus*; widow, *S. entomelas*; copper, *S. caurinus*; and greenspotted rockfish, *S. chlorostictus*), widow rockfish showed a high probability of being detected at platforms over a 2-year period. Vermilion rockfish emigrated away from the shallower Platform Gilda (64 m) faster than vermilion rockfish tagged at the deeper Platform Grace (93 m). Ten tagged individuals (8 vermilion, 1 copper, and 1 lingcod (*Ophiodon elongatus*)) moved between platforms (range 5–15 km) and/or natural habitat, although a majority moved from a shallower platform to a deeper one. These movements further support evidence that many reef-associated rockfishes make ontogenetic shifts to deeper water, and therefore, shallower platforms export fishes faster than deeper platforms. Observed movements of fishes between platforms and natural reef habitat indicate that they can navigate between these habitats and that platform habitat. Despite high background noise and sound occlusions associated with platforms, acoustic telemetry may be the best technique to quantify site fidelity of marine organisms associated with these structures.

86. HOMING AND HABITAT USE OF ROCKFISHES AROUND OIL PLATFORMS IN THE SANTA BARBARA CHANNEL.

K.M. Anthony and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA, 90840.

To test an option that may mitigate the effects of offshore oil platform removal, 79 platform-associated rockfishes and lingcod from three platforms in the east Santa Barbara Channel were acoustically tagged and translocated to a natural reef inside the Anacapa Island State Marine Reserve to determine whether fish would home back to their platforms of capture, or take residency at their new location. In a reciprocal experiment, 19 fish from a natural reef were tagged and released at two oil platforms to assess whether they would home or remain there. Twenty-five percent of all tagged fish translocated to Anacapa Island homed back to the platforms from where they were caught, traveling distances of 11–18 km. Some fish that homed made movements between platforms and natural habitat, and back to Anacapa Island, traveling cumulative distances >30 km. The remaining 75% of non-homing fish either took residency at Anacapa inside the acoustic array, moved to Santa Cruz Island, or out of the range of detection. Although a small proportion (21%) homed back to a natural reef after translocation to two oil platforms, a higher proportion (79%) remained at their platforms of release, or moved out of the range of detection shortly after release. Some individuals showed movement between natural and platform habitat in the same day, suggesting use of both habitat types concurrently. Results from these experimental manipulations provided insight into how some individuals might evaluate and utilize habitat.

87. FISH RECRUITMENT AT PLATFORMS IS LINKED TO OCEAN CURRENT PATTERNS

M.M. Nishimoto[1], L. Washburn.[2,3], M.S. Love[1], D.M. Schroeder[4], and B.M. Emery[3]. [1]Marine Science Institute, University of California, Santa Barbara, CA 93117; [2]Department of Geography, UCSB; [3]Institute for Computational Earth System Science, UCSB; [4]Minerals Management Service, Pacific OCS Region, Camarillo, CA.

Two oil/gas production platforms, Gail and Gilda, in the eastern Santa Barbara Channel, CA, were used as study sites to examine: (1) the extent to which variability in reef fish settlement at the two platforms can be explained by physical oceanographic processes and (2) the likelihood of fish recruits encountering natural reef habitat if the platforms had been removed from their places. The two platforms historically have been sites of relatively high levels of juvenile rockfish recruitment in the Channel region. Juvenile fish settlement was estimated from SCUBA surveys conducted every 3–4 days. Bocaccio (*Sebastes paucispinis*), presently declared over-fished by the National Marine Fisheries Service, was the most abundant species observed. Water mass analysis and ocean current variability indicate that currents from the Southern California Bight rather than from central California delivered juvenile rockfishes to the platforms. Using calculated surface current trajectories from Gilda and subsurface current measurements, we estimate that the majority of juvenile rockfish recruits from the offshore eastern Channel platforms, had the structures not been in place, would have been transported to the mainland coast east of Santa Barbara where rocky reef habitat is uncommon.

88. SAN PEDRO SHELF PLATFORM FISH ASSEMBLAGES AND RELATIONS TO HABITAT QUALITY

C.J.B. Martin*, B.J. Allen, and C.G. Lowe. Department of Biological Sciences, California State University, Long Beach, CA 90840.

Evidence exists of potential ecological benefits gained from offshore petroleum platforms in southern California, however, the relationship between associated fish assemblages and platform habitat quality has been difficult to empirically assess. The midwater (maximum depth of 31 meters) fish assemblages associated with the San Pedro Shelf platforms were systematically surveyed using SCUBA methods over a period of two years. Data revealed a stable resident fish assemblage dominated by nearshore reef species (e.g. *Chromis punctipinnis*, *Semicossyphus pulcher*, *Hypsypops rubicundus*, and Serranidae species); some of which exhibited evidence of reproductive biomass production. Meanwhile, schooling pelagic species (e.g. *Trachurus symmetricus*) dominated, but were only present during the summer and autumn months. The resident fish assemblage was observed to be significantly influenced by the presence of the thick sessile invertebrate layer, as a hydrocleaning operation at one platform altered total fish density. An asymmetrical ANOVA revealed a significant difference in the mean resident fish density at platform Elly (impacted) compared to three control communities ($F_{1,36} = 9.854$, $p = 0.0034$). This was caused by a greater temporal variation within the year following the hydrocleaning compared to the previous year ($F_{6,12} = 3.3512$, $p = 0.0354$), observed as a dramatic decrease following the disturbance. By 12 months post-disturbance, fish densities began to exhibit signs of recovery. The detrimental impact on total fish density caused by the removal of the invertebrate layer indicates its importance in the habitat quality at southern California petroleum platforms for reef fishes.

89. THE SITE FIDELITY AND DEPTH DISTRIBUTION OF SHALLOW OCCURRING NEARSHORE REEF SPECIES INHABITING OFFSHORE PETROLEUM PLATFORMS ON THE SAN PEDRO SHELF

Carlos Mireles and Christopher G. Lowe. Department of Biology, California State University Long Beach, 1250 Bellflower Blvd, CA, 90840.

As platforms along the California coast become less economically viable, debate over decommissioning alternatives continue. Much of the debate has been fueled by a lack of understanding of how platforms function as critical habitat for fishes. We used acoustic telemetry to monitor the site fidelity and depth distribution of adult cabezon (*Scorpaenichthys marmoratus*), California sheephead (*Semicossyphus pulcher*), grass rockfish (*Sebastes rastrelliger*), and kelp rockfish (*Sebastes atrovirens*) inhabiting one

shallow (50 m) and one deep (225 m) platform located 12 km off the coast of Huntington Beach. By the end of the study (1.5 yrs), 73% of sheephead tagged were still present, followed by grass rockfish (50%), kelp rockfish (47%) and cabezon (47%). All fish tracked were closely associated with horizontal support structures on each platform. Grass and kelp rockfish were found to primarily utilize shallower depth levels (10–20 m) across all seasons. During summer warm water periods, cabezon primarily reside at deeper levels (40–188 m) and sheephead at shallower (15–20 m), with both species displaying an overlapping depth distribution at 30–55 m during cold winter periods. Individuals tagged on the deeper platform did utilize depths greater than those available on the shallower platform, with cabezon being the only species to utilize depths greater than 100 m. These findings suggest that platforms can support individuals for extended periods of time and that depth specific habitat characteristics must be considered in choosing the most appropriate decommissioning option to meet conservation goals.

90. WHAT CAN OIL PLATFORM STUDIES TELL US ABOUT THE POTENTIAL ECOLOGICAL CONSEQUENCES OF OFFSHORE RENEWABLE ENERGY?

D.M. Schroeder and A. Scarborough-Bull. Minerals Management Service, 770 Paseo Camarillo, Camarillo, CA, 93010.

Renewable energy on the Outer Continental Shelf (OCS) remains a frontier industry in the United States, so there are few data available to understand and predict potential ecological impacts from future installations. Studies related to the offshore oil and gas industry provide one source of information to aid in environmental assessment. This report reviews and analyzes past research to understand potential consequences to marine life of the operations phase of renewable energy production in the Pacific region. Most applicable are studies that deal with direct effects, specifically habitat alteration of the local area. The context and intensity of impacts will vary according to the specific size and configuration of a proposed project, and the technology used (wind or wave energy devices). Indirect effects are more difficult to predict, but one of the most important impacts will be the enhancement or exclusion of other uses of the OCS. For example, certain fishing practices may be excluded within and nearby renewable energy installations, creating de facto marine protected areas. We currently observe that some offshore oil platforms act in this function. The indirect effects of exclusion are likely to be consistent across proposed projects regardless of the method of offshore energy production

91. RETHINKING THE PARADIGM: THE CLAY ARTIFACTS FROM CA-ORA-64, THEIR SIGNIFICANCE, AND PLACE WITHIN THE EARLY CERAMIC COMPLEX OF SOUTHERN CALIFORNIA AND ADJACENT REGIONS.

Edgar Huerta. Department of Anthropology, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA 92831.

Ceramic technology in southern California and adjacent regions is often considered a late pre-historic development occurring roughly between 900 A.D.–1000 A.D. However, specific archaeological sites have produced clay artifacts occurring within much earlier contexts. Such is the case of CA-ORA-64 which has yielded clay artifacts from the later part of Horizon II (Milling Stone or La Jolla complex) 8000 B.C–3000 B.C. Such early dates often spark controversy. Examining sites in other regions similar to CA-ORA-64 might provide evidence to rethink the current paradigm emphasizing a late pre-historic development of ceramic technology in southern California. Consequently, this paper addresses the importance of analytical techniques being used in the production of data that would help in the development of new perspectives regarding the early ceramics from CA-ORA-64 and adjacent regions.

92. ZOOARCHAEOLOGICAL EVIDENCE FOR A TRANS-HOLOCENE "BROAD-SPECTRUM REVOLUTION" ON THE CALIFORNIA COAST.

Judith F. Porcasi. Cotsen Institute of Archaeology at UCLA, Los Angeles, CA, 90095.

Allometric estimation of faunal biomass, combined with chronological sequences of abundance indices, is used to explore coarse-grained variations in exploitation of faunal resources at 17 coastal and

pericoastal archaeological sites along the Central and Southern California Coast over a 10,000-year timespan. Patterning of preferential use of various faunal classes is revealed, including a remarkably sustained reliance on shellfish. Surprisingly, however, overall consumption of all classes of animal flesh decreased markedly throughout the region over time even though populations grew and societies became more complex. This pattern is consistent with the pervasive adoption of a more carbohydrate-focused diet incorporating lesser quantities of faunal protein. A long-term Pleistocene-to-Holocene adaptive "revolution" by coastal populations is suggested.

93. SAN CLEMENTE ISLAND STEATITE SOURCING

Amy L. Tupa. California State University Long Beach, Department of Anthropology, Long Beach, CA 90840.

Steatite artifacts on San Clemente Island include comals, effigies, bowls, ground stone, donut stones, beads, flakes, mortars, pendants, and caches of unmodified steatite. There are no geological sources of steatite on San Clemente Island, meaning that the steatite found on the island was imported from outside sources. Laser-ablation time-of-flight ICP-MS measures elemental concentrations, and in doing so is able to produce characterizations of steatite samples. Statistical comparisons of the compositions, produced by my analyses combined with other evidence indicate the source of San Clemente Island steatite as Santa Catalina Island steatite quarries. The results of this study are able to provide evidence in support of the long held assumption made by archaeologists that the steatite artifacts found on San Clemente Island were imported from neighboring Santa Catalina Island, and not mainland sources. The results here also demonstrate the utility of LA-ICP-MS in sourcing steatite artifacts.

94. THE NINTH CHANNEL ISLAND: ARCHAEOLOGICAL INVESTIGATIONS AT ABALONE COVE ON THE PALOS VERDES PENINSULA.

Steven R. James and Gary Jones. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

The California Channel Islands and adjacent mainland coastal sites are providing significant information to researchers regarding the origins of social complexity, natural resource utilization patterns, and the peopling of North America. Through a partnership with the Palos Verdes Peninsula Land Conservancy, field classes from California State University at Fullerton conducted surveys and test excavations at Abalone Cove on the Palos Verdes Peninsula during the Fall 2007 and 2008 field seasons. Preliminary results of the research are presented and comparisons are made with other coastal and island sites.

95. MARINE DINOFLAGELLATES FROM THE OLIGOCENE OTAY FORMATION, SAN DIEGO COUNTY, SOUTHERN CALIFORNIA

L.H. Fisk. PaleoResource Consultants, 550 High Street, Suite #108, Auburn, CA, 95603. . J. Lucas-Clark. Clark Geological, Inc., Fremont, CA 94536. . L.R. Pratt. PaleoResource Consultants, Auburn, CA, 95603.

A variety of opinions exist regarding the depositional environment of the Oligocene Otay Formation in the San Diego area. Cleveland (1960) suggested deposition occurred in a shallow marine shelf environment, stating that primary bentonite beds like those in the Otay Formation are "*formed by hot volcanic ash that falls directly into the sea....*" Later workers interpreted the Otay Formation as being alluvial fan, braided river, lacustrine, or even playa in origin based on lithologic evidence and an abundance of terrestrial vertebrate fossil remains. Most recently, based on the geochemistry of the Otay primary bentonite beds, Berry (1999) suggested an environment of deposition consistent with that of Cleveland (1960), but broadened Cleveland's use of the term "*sea*" to mean "*quiet, shallow, near-shore environments.*" Excavations at construction sites along the western flank of the San Ysidro Mountains southeast of San Diego, exposed over thirty five (35) feet of primarily volcaniclastic sediments of the Otay Formation resting directly on metamorphic rocks of the Jurassic Santiago Peak Volcanics. This section includes both secondary and primary bentonites. Samples of fine-grained, carbonaceous sediments in this

section were processed to recover acid-insoluble microfossils to aid in the interpretation of their depositional environment. Some samples produced dinoflagellates, suggesting marginal-marine to open marine conditions for the Otay Formation. Since all taxa were consistent with, albeit not diagnostic of an Oligocene age, they are probably not reworked from older marine strata.

96. STRATIGRAPHIC LEAKAGE OF TERTIARY PALYNOMORPHS INTO BEDFORD CANYON FORMATION LIMESTONE, SANTA ANA MOUNTAINS, SOUTHERN CALIFORNIA

L.H. Fisk. PaleoResource Consultants, 550 High Street, Suite #108, Auburn, CA, 95603. . G.J. Jaecks. American River College, Sacramento, CA 95841, D.M. Haasl. PaleoResource Consultants, Auburn, CA, 95603, D.F. Maloney. PaleoResource Consultants, Auburn, CA, 95603, M.R. Roeder. Paleo Environmental Associates, Inc., Costa Mesa, CA, 92626.

An isolated limestone lens exposed on the northeast flank of the Santa Ana Mountains southwest of Corona, California, has been referred to the Bedford Canyon Formation based on the presence of rhynchonellid brachiopods. These brachiopods are consistent with a Jurassic or Triassic age for the Bedford Canyon. Originally these outcrops were thought to be Carboniferous. Samples of this limestone were processed to recover acid-insoluble microfossils in order to confirm their age and aid in the interpretation of their depositional environment. Some samples produced a mixed population of microfossils, including Tertiary spores, pollen, and dinoflagellates. We interpret the charcoalified components in this assemblage to be in situ. Unfortunately, these microfossils have been heated to temperatures that have destroyed diagnostic features, making them unidentifiable and their age uncertain. The non-charcoalified microfossils are Tertiary in age and are interpreted to be contaminants that leaked from an overlying stratigraphic unit into open limestone fractures that later healed through calcite recrystallization. The overlying unknown stratigraphic unit was presumably completely eroded away following uplift of the Santa Ana Mountains. This study is another example demonstrating that stratigraphic leakage of palynomorphs from overlying sediments into older limestones is not an uncommon problem.

97. NEOGENE HERPETOFAUNAS FROM LOUISIANA, USA AND THEIR BIOGEOGRAPHICAL AND PALEOENVIRONMENTAL SIGNIFICANCE

M.J. Williams. Natural History Museum of Los Angeles County, Department of Vertebrate Paleontology, Los Angeles, Ca 90007.

Before the discovery of the late Barstovian herpetofauna from Fort Polk, Louisiana and the Hemphillian Tunica Hills/Kerry (THK) locality approximately 175 km to the east southeast, Neogene fossil herpetofaunas from Louisiana were unknown. The Fort Polk herpetofauna is currently being worked on, and so far, consists of ranid frogs; salamanders, including *Batrachosauroides*; colubrine, natricine, and viperid snakes; lizards similar to *Eumeces*; crocodilians, and turtles. Through the use of mammalian biostratigraphy and paleomagnetic dating techniques, the six herpetofaunal bearing sites at the Fort Polk locality have been dated and are equivalent to the Cold Spring Local Fauna of eastern Texas. The well-constrained ages coupled with close geographic proximity of the Fort Polk sites (< 5 km apart) are important and afford the opportunity to study localized events, such as shifting depositional environments during a regression, and faunal changes, which can be broadened to elucidate continental and global biogeographical trends, for instance the global spread of colubrid snakes from the early to middle Miocene. Thus far, the THK locality has produced ranid frogs, natricine snakes, crocodilian teeth, turtles, and indeterminate salamanders, with more material currently under study. The Hemphillian age for the locality was determined using mammalian biostratigraphy. Together, the THK and Fort Polk localities offer a glimpse of middle to late Miocene herpetofaunas within a small geographic area of central Louisiana.

98. LATE PLEISTOCENE FOSSILS FROM THE PACIFIC CITY PROJECT SITE IN HUNTINGTON BEACH, SOUTHERN CALIFORNIA

M.A. Roeder. Department of Paleontology, San Diego Natural History Museum P.O. Box 121390, San Diego, CA 92112.

During two phases (1999, 2006) of earthmoving during construction of the Pacific Center Project in Huntington Beach, paleo monitoring yielded significant fossils. The project was on an old oil production property at the intersections of Huntington Drive and Frist Street with Pacific Coast Highway. In the 1999 phase, isolated bones of extinct *Equus*, *Bison* and *Mammuthus* recovered from sediments interpreted as a paleoenvironment of aeolian (dune) sands. In addition, a second type of fossil occurrence on the property consisted of the remains of small vertebrates and land snails in sandy silts interpreted as a paleoenvironment of flat areas between aeolian dunes. One of these deposits dated 19890+/− 120 years BP. During the second phase (2006), a thin charcoal- bearing sandy siltstone at the base of a stratigraphic section yielded pollen, spores, seeds, ostracods, snails, a clam, bony fish, amphibians, reptiles, small mammals and a bird. This site was radiocarbon dated at 40980+/− 800 years BP. Pollen and spores recovered were dominated by herbs, grasses and freshwater algae. The presence of algae, ostracods, mollusks, bony fish, and amphibians suggests that the paleoenvironment of this site was a permanent or vernal pond in a dune field. Also, the interpretation of the paleoflora suggests the paleoclimate of this site was cooler and wetter than the present climate, and possibly more like coastal central California.

99. POPULATION DYNAMICS AT A SHIFTING RANGE BOUNDARY BETWEEN SISTER SPECIES OF ESTUARINE SEA SLUG: ROLE OF THE PHYSICAL ENVIRONMENT VERSUS LARVAL SUPPLY

M.N. Garchow and P. Krug. CSU Los Angeles, Department of Biology, Los Angeles, CA, 90032.

Intertidal animals that occur along linear strips of coastline are ideal models for studying the causes of range limits, and for predicting how ranges may shift due to climate change. The estuarine sea slugs *Alderia modesta* and *A. willowi* share a dynamic range boundary between Bodega Harbor and San Francisco Bay, which has likely shifted 180 km north over the last 50 years. We quantified field densities of both species along replicate transects in SF Bay, and correlated abundance with *in situ* measurements of temperature, salinity and habitat suitability. The southern species *Alderia willowi* colonizes SF Bay each September, after high temperatures kill off most *A. modesta*. Conversely, most *A. modesta* recruit in March after low salinity and possible competitive interactions eliminate *A. willowi*. Size-frequency distributions revealed two major recruitment events for each species early in their respective seasons, indicating supply-side processes are important to metapopulation dynamics of these slugs. However, the lack of subsequent recruitment refutes the hypothesis that range limits occur because the continuous influx of maladaptive alleles from the range center inhibits adaptation to stressful edge conditions. Instead, the seasonal gradient in conditions exceeds the adaptive potential present in annual settlement cohorts, favoring first one species and then the other. These findings illuminate the biological and physical factors setting the permanent range boundary at Bodega Harbor, and may be used to predict future range shifts of estuarine animals due to increasing temperature and changing hydrology along California's coastline.

100. NITRIC OXIDE SIGNALING REGULATES LARVAL METAMORPHISIS IN A HOST-SPECIALIZED SEA SLUG.

M.R. Romero and P.J. Krug. California State University, Los Angeles, Department of Biology, Los Angeles, CA 90032.

Marine invertebrates produce planktonic larvae that settle indiscriminately at a certain age, or selectively in response to environmental cues of habitat suitability. In diverse animals, the timing of metamorphosis is regulated by nitric oxide synthase (NOS). Inhibition of NOS reduces nitric oxide (NO) and its downstream second messenger, cyclic guanosine monophosphate (cGMP), and triggers metamorphosis in species with no environmental cue. We investigated whether the NO pathway regulates metamorphosis in larvae of a host specialist, the sea slug *Alderia willowi*, which expresses an unusual dimorphism: some larvae from an egg mass spontaneously metamorphose upon hatching, while the remainder metamorphose only after encountering a cue from the adult host algae. Pharmacological reduction of NO and cGMP increased spontaneous metamorphosis among newly hatched larvae. Inhibition of NO did not trigger metamorphosis in older larvae, but potentiated their dose-response to habitat cues: larvae had increased sensitivity to the algal cue when NO signaling was suppressed. These findings also suggest a mechanism for maternal control over the proportion of spontaneous metamorphosis: regulation of the per-egg amount of L-arginine, the

substrate for NOS. Under optimal conditions, mothers could decrease arginine causing a higher percentage of larvae to metamorphose without dispersing. However, a mother's ability to vary the habitat choice behavior of her offspring may be constrained because the same pathway controls spontaneous and environmentally-cued metamorphosis. Mothers that reduce the amount of spontaneous metamorphosis can adaptively increase dispersal among their offspring, but may consequently produce less choosy larvae that settle in response to weaker habitat cues.

101. COMPARATIVE PHYLOGEOGRAPHY OF CARIBBEAN SEA SLUGS WITH LONG-LIVED VS. SHORT-LIVED LARVAE

Danielle Y. Trathen. California State University, Los Angeles.

Predicting patterns of gene flow is important for conservation and management of marine animal populations. Biophysical coupling models have been developed for the Caribbean that use ocean currents and the lifespan of planktonic larvae to predict whether populations will be genetically connected or isolated. To test model predictions, we determined population genetic structure for the sea slugs *Elysia patina* and *E. zuleicae* which have a 30-day planktonic larval period. A portion of the mitochondrial cytochrome *c* oxidase I gene was sequenced for samples from 13 Caribbean locations. Phylogenetically distinct clades were identified by Bayesian Inference, and Analysis of Molecular Variance (AMOVA) was used to determine realized gene flow among islands. Despite its considerable potential for larval dispersal, *Elysia patina* had surprisingly high population structure; clades were up to 10% divergent, and several were restricted to one island. In contrast, the co-occurring *E. zuleicae* had little structure, but also comprised two major clades that were 10% divergent. In contrast to published predictions from oceanographic models, there was no east-west break across the Caribbean, but there were deep barriers to gene flow among neighboring islands in the Bahamas. Larval life span is thus a poor predictor of realized dispersal, and current models do not accurately predict larval exchange for common Caribbean molluscs. Differences in larval behavior may explain why less migration has occurred among populations of *E. patina* on historical and recent time scales, compared to other *Elysia* spp.

102. STABLE ISOTOPE ANALYSIS OF A SEAGRASS FOOD WEB IN SAN DIEGO BAY

J.P. Farlin. Fish Ecology Laboratory, San Diego State University, San Diego, CA, 92115.

Stable isotopes of nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) were used to examine food web structure in a seagrass bed in San Diego Bay. Stable isotopes are used in food web studies because they act as natural tracers of feeding habits *in situ*. $\delta^{13}C$ signatures are generally conserved throughout trophic levels and are used to trace carbon from various sources of primary production, while $\delta^{15}N$ values increase 3–5‰ per trophic level and are used as an indicator for trophic position. Amphipods traditionally have been viewed as functionally redundant; however, results from recent studies have challenged this view by describing specialized feeding behaviors among amphipod taxa. If amphipods use different sources of primary production, their carbon signature will differ to reflect their dominant food source. If these amphipod families differ in trophic position, then we should observe differences in $\delta^{15}N$ values reflecting herbivorous, carnivorous, or omnivorous diets. Ordination has suggested that some isotopic differences might be present which could be ecologically important. For example, *Ischyoceridae* and *Ampithoidae* amphipods feed at the same trophic level (primary consumers); however, appeared to have different feeding preferences based on their differing $\delta^{13}C$ values. Additionally, supplemental taxa from the seagrass ecosystem were examined in order to allow greater interpretation of the amphipod signatures. Although the study is incomplete, the observed differences corresponded with recent literature indicating diverse feeding behaviors in the amphipoda. By further increasing our sample sizes, we aim to improve our chances to detect any real differences in the trophic ecology of these taxa.

103. DOCUMENTATION OF THYROID ENDOCRINE DISRUPTION IN PACIFIC STAGHORN SCULPIN (*LEPTOCOTTUS ARMATUS*) AND SHINER SURFPERCH (*CYMATOGASTER AGGREGATA*) RESIDING IN SAN FRANCISCO BAY

N.B. Brar[1,2], C.M. Waggoner[1,2], J.A. Reyes[1,2], R. Fairey[3], and K.M. Kelley[1,2]. [1]Environmental

Endocrinology Laboratory Department of Biology, CSULB, CA 90840; [2]Institute for Integrated Research on Materials, Environment, and Society, CSULB, CA 90840; [3]Marine Pollution Studies Laboratory, Moss Landing Marine Laboratories, CA.

San Francisco Bay (SFB) includes a diversity of estuarine and inshore marine environments known to be contaminated with chemicals from heavily industrialized urban populations. Many of these chemicals are industrial by products and lipophilic with high bioaccumulation in adipose and fatty tissues of animals. Two classes of chemicals found in SFB, polychlorinated biphenyls (PCBs) and flame retardants polybrominated diphenyl ethers (PBDEs), are lipophilic and found to have thyroid-disrupting effects in laboratory experiments, suggesting these chemicals to be thyroid system disruptors. Our study objectives were to determine whether thyroxine (T4) and triiodothyroinine (T3) are altered by environmental conditions in two wild fish species, shiner perch (*Cymatogaster aggregata*) and Pacific staghorn sculpin (*Leptocottus armatus*). A total of 285 fish were collected from various locations within SFB. Some of these sites included Richmond Lauritzen Channel, Redwood City, and two far-field reference sites Bodega Bay and Tomales Bay. Blood plasma was collected from all individual fish and analyzed for T4 & T3 concentrations using enzyme-linked immunoabsorbent assays (EIA). Hepatic tissues of fish samples were analyzed for contaminant concentrations using Gas Chromatography/Mass Spectrometer (GC/MS) from the IIRMES facility, at CSULB. T4 and T3 plasma concentrations were found be altered at different locations. Contaminant concentrations of fish exhibited site related differences with significant differences found among PCB congeners and pesticides. These contaminants were found to be significantly correlated with T4 & T3 levels. Environmental endocrine disruption of wild fish in SFB seems to include alterations of the thyroid system and association with accumulation of certain environmental contaminants.

104. FACTORS THAT ELICIT A SWITCH IN LARVAL DEVELOPMENT OF THE SEA SLUG ALDERIA WILLOWI

Dominique Gordon and Patrick Krug. Biological Sciences, California State University, Los Angeles.

Environmental cues can trigger phenotypic plasticity in a wide range of organisms. *Alderia willowi* seasonally switch developmental mode of their offspring between larger non-feeding lecithotrophic larvae in the summer and smaller feeding planktotrophic larvae in the winter. We wanted to maintain lecithotrophic development in the lab for purposes of performing multi-generation selection experiments, but past students were unable to get the slugs to maintain lecithotrophic development when raised under lab conditions. Factors that cause adult *A. willowi* to switch larval development may be temperature, seawater salinity, or growth rate. I tested the hypothesis that high temperature, high salinity, or both would cause laboratory reared slugs to express lecithotrophic development by mimicking summer conditions.

105. SURVIVAL AT THE EDGE: ECOPHYSIOLOGY AND RANGE LIMITS OF *ALDERIA*

E.L. Shimer and P.J. Krug. California State University, Los Angeles, Department of Biology, Los Angeles, CA 90032.

Despite the fundamental importance of range limits in ecology and evolution, little is known about the factors that set geographical limits in marine animals. The sea slugs *Alderia modesta* and *A. willowi* respectively occur north and south of San Francisco Bay, where they seasonally alternate in abundance. At this dynamic range boundary, *Alderia modesta* displaces *A. willowi* after winter rains, and *A. willowi* recolonizes after peak summer temperatures. We tested whether the sister species differ in tolerance to high temperature and low salinity across three life-history stages by simulating a series of stressful low-tide events in lab assays. Egg masses, larvae and adults of the northern species *A. modesta* survived in water down to 8 ppt. In contrast, egg masses of A. willowi experienced 50% mortality at 16 ppt and larvae died below 12 ppt. Survival analysis confirmed that adults differed in their physiological tolerance: *A. modesta* survived repeated exposure to nearly fresh water (2 ppt) whereas salinities below 4 ppt were fatal to most *A. willowi*. Conversely, some *A. willowi* survived repeated exposure to 34°C, but *A. modesta* did not survive one exposure to 32°C. These thresholds are consistent with observed die-offs of *A. modesta* in the field in

2008 and 2009, when mud surface temperatures exceeded 32°C. Physiological tolerance for different environmental stressors therefore sets the range limits of *Alderia* spp., and may determine future range shifts in response to warming trends and predicted changes in estuarine hydrology

106. POSSIBLE MACROBENTHIC COMMUNITIES IN THE DEEPEST OCEAN HADAL TRENCHES

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037.

There are five hadal trenches with sections in excess of 10,000 meters depth and these hadal environments are the deepest marine ecosystems on Earth. The trenches are all in the Western Pacific (Marianas, Tonga, Philippine, Kurile-Kamchatka and Kermadec). There are two possible macrobenthic communities present in these 10,000 meter ecosystems. One would involve colonies of the actinarian anthozoan *Galatheanthemum profundale*. This species is cosmopolitan in distribution and is found in deep sections of hadal trenches in the Pacific and Atlantic oceans. A colony of *G. profundale* has been imaged in the deepest section of the Puerto Rico Trench. Another possible macrobenthic community might be some type of chemosynthetic community such as hydrothermal vents, methane seeps and whale falls. Vesicomyid bivalves have been trawled in deep hadal trench depths in the Western Pacific by the Russian R/V: *VITYAZ*. Specimens were collected in the Marianas (10,730 m), Kurile-Kamchatka (9500 m) and Kermadec (9100 m) trenches. Although vesicomyid bivalves may be transported debris from trench walls, they also may indicate the possible presence of some type of chemosynthetic community. Perhaps the exploration of the deepest hadal trenches with the new Hybrid Remotely Operated Vehicle: *NEREUS* will provide evidence for the existence of these macrobenthic communities.

107. INTERNAL OCEAN SURFACING ON THE JUPITER SATELLITES EUROPA AND GANYMEDE

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037.

The three ice moons of Jupiter are thought to have internal oceans. Callisto has an internal ocean beneath a 300 km crust so surfacing of the internal ocean on Callisto would be considered a rare occurrence. As it is, there is no evidence that an internal ocean ever surfaced on Callisto. There is evidence, however, that internal oceans have surfaced on Europa and Ganymede. On Europa, chaotic terrain has formed from large blocks of crust floating on a layer of subsurface water. Also on Europa, young deposits of ice have risen to the surface between areas of older crust. Large dark streaks on the surface of Europa are large fractures which are rich in salts deposited by the evaporation of subsurface water. The red and yellow coloration of these fractures is from the presence of iron and sulfur compounds in the fractures. Europa has a crust which is only 1 to 2 km in thickness. On Ganymede, bands of young terrain between large dark areas of older cratered terrain are comprised of subsurface ice which has recently penetrated the surface. The internal ocean in Ganymede is a 2 to 3 km layer of water beneath the 170 km crust. These areas on Europa and Ganymede where the internal oceans have surfaced are possible destinations for future unmanned lander missions. These areas of internal ocean surfacing may contain microbes from internal ocean ecosystems.

108. EVAPORATION OF OCEANS ON THE SURFACE OF MARS

Kent D. Trego. Center for Planetary Oceans, Nautilus Oceanic Institute, La Jolla, California 92037.

At one time in its history, the planet Mars had a significant ocean presence on its surface. Oceans are thought to have existed in the northern lowlands of Utopia Plainitia and in the planetesimal craters of the southern hemisphere Hellas Plainitia and Argyre Planitia. The Martian oceans had a significant shorter time of existence and were also much shallower than the oceans on Earth. Oceans on Mars are thought to have existed some time between 3.2 and 2.0 b.y. and may have lasted around .5 b.y. in the northern

lowlands. After the Martian atmosphere dissipated, evaporation of Martian oceans took place. Two sets of Martian shorelines in the northern hemisphere formed before polar wandering on Mars and may represent declining ocean levels due to evaporation. The shorelines are more reserved than those found on Earth because of the lack of a strong tidal influence by the two Martian moons which are likely captured asteroids. Mars missions found areas on the surface where the acidic levels of water were significantly different. Evaporation of oceans on Mars would result in the isolation of ocean water areas in the lowest elevation locations such as the floors of impact craters. This would result in different levels of acidity. Imagery taken on the surface of Mars by unmanned lander and rover missions has not yielded any evidence of present life or fossil evidence of past life. This includes areas in the dry ocean basins of Mars which have been imaged by recent Martian rover missions. A limited evolution in the surface oceans of Mars may imply that only microfossils should be expected in the dry ocean basins of Mars. Future unmanned missions to Mars should concentrate on the search for microfossils of potential pelagic and benthic organisms such as foraminifera.

109. COMPARATIVE HISTOLOGY OF THE DIGESTIVE TRACT IN THE SOUTH AMERICAN PARASITIC CATFISHES (TELEOSTEI, TRICHOMYCTERIDAE)

Diep Brian[1], Jonathan N. Baskin[2], and Andrew Chen[2]. [1]San Gabriel High School, San Gabriel, CA, 91776; [2]California State Polytechnic University Pomona, Department of Biological Sciences, Pomona, CA, 91768.

Many species of the widespread Neotropical catfish family Trichomycteridae are known for their parasitic habits of feeding on blood, scales and mucus of other fishes, while other species of the family are more generalized predators mainly on insects. We define specific characteristics of the parasite digestive tract, and find that the digestive tract of the parasites has become reduced, with the stomach lacking and the intestine simplified to a straight tube with a reduced wall (muscularis layer) and reduced internal surface area (few or no villi). We hypothesize that the intestine has lost most of its digestive function and serves mainly as a holding area. However the parasites have developed a distinct rectal region not found in other catfishes, which appears to be a major site of digestive product absorption in the parasitic species. One species of the parasitic group, *Pareiodon microps* from the Amazon, has reverted back to a predatory habit of feeding on fish flesh. *P. microps* is found to have a basic parasite digestive tract but redeveloped a strong intestinal wall, as well as intestinal villi, and further developed an enlarged rectum. The internal structure of the *P. microps* gut is more complex compared to other members of the family. Some related species of unknown feeding habits (*Ituglanis amazonica*) have some digestive tract features characteristic of parasitic species.

110. CRYPTIC SPECIES AND SYNONYMS: A RECLASSIFICATION OF THE TROPICAL SPURILLA GENUS

Bonnie R. Lei. Walnut High School, 400 North Pierre Road, Walnut, CA 91789. Department of Biological Sciences, California State Polytechnic University, Pomona, 3801 West Temple Avenue, Pomona, CA 91768-4032..

Tropical Atlantic and Pacific populations of *Spurilla neapolitana* (delle Chiaje, 1841), a widely recognized aeolid due to its breadth of vivid coloration and distribution, and *S. sargassicola* (Kroyer, 1861) are assessed with the purpose of determining the possibility of synonymy between these two species as well as the presence of potential cryptic species.

Complete specimens are compared using morphological and genetic characteristics. Hypervariable 16S rRNA and highly conserved H3 histone gene revealed *S. sargassicola* to be genetically similar to Atlantic *S. neapolitana* and the Bahamas population of *S. neapolitana* to have the most divergence from other *Spurilla* sequences. Morphological evaluation of diagnostically reliable features including the external morphology, radulae, jaws, and reproductive system through SEM micrographs, camera lucida, and digital photography further corroborated the genetic findings.

With the presented data, it is clear that *Spurilla sargassicola* is a synonym of *S. neapolitana*, and thus should not retain a separate name. Furthermore, the population of *S. neapolitana* located in the Bahamas is identified as a likely cryptic species, which will be verified with sequences of an outgroup when

specimens are obtained. Determination of the population structure of these *Spurilla* species will contribute to understanding the influence of environmental change on this genus through factors such as global warming.

111. AN ANALYSIS OF COYOTE AND FOX DIETARY HABITS IN THE PALOS VERDES LAND PRESERVES, PALOS VERDES PENINSULA, LOS ANGELES COUNTY, CALIFORNIA

Mitchell, Alayna[1] and Dalkey, Ann[2]. [1]Torrance High School, 2200 West Carson Street, Torrance, CA 90501; [2]Palos Verdes Peninsula Land Conservancy, 916 Silver Spur Road, Suite 207, Rolling Hills Estates, CA 90274.

The coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*) and red fox (*Vulpes vulpes*) are important to the ecological health and biodiversity of the coastal sage scrub habitat on the Palos Verdes Peninsula. The close proximity of urbanized areas and exposure to anthropogenic materials may influence the dietary resources available to these canids. This study evaluated the dietary habits of coyote and fox inhabiting the Peninsula by microscopically examining scat samples found in various land preserves. Results suggested that the close proximity of urban areas have affected canid diets on the Peninsula. Although typical in the literature as primary food sources for wild canids, lagomorph and rodent remains were entirely absent from the scat samples of coyotes and foxes on the Peninsula. Domestic animals and cultivated vegetation were consumed at a higher rate than expected. The outcomes of this study were compared to findings from similar habitats and geographic regions. Results suggest that the effects of such an alternate food supply on canid health and behavior should be evaluated.

112. ANTS AS SYMBIOTIC PARTNERS AND HABITAT QUALITY INDICATORS FOR *GLAUCOPSYCHE LYGDAMUS PALOSVERDESENSIS*, THE PALOS VERDES BLUE BUTTERFLY

Ariel Takayanagi. Palos Verdes High School.

Glaucopsyche lygdamus palosverdesensis, the Palos Verdes blue butterfly, was assumed extinct for eleven years. However, since it was rediscovered in 1994 at the Defense Fuel Supply Depot, San Pedro, California, numerous studies have been done to identify the optimal habitat for the butterfly's survival. Presence or lack of ants can be used as an indicator of habitat quality. The purpose of this investigation was to find out whether a level of diversity of ant species similar to that of DFSP would be found at four potential butterfly reintroduction sites. The preserves surveyed included George F. Canyon Nature Preserve and Linden H. Chandler Preserve, two *G. L. palosverdensis* re-introduction sites, and Three Sisters and Alta Vicente Reserves. The hypothesis was that the number of ant species would be significantly fewer at the four reserves that at DFSP. The presence of native species could indicate that the habitat is healthy for the *G. L. palosverdensis*, while the domination of invasive exotic species would indicate instability in the habitat. In addition, ants are known to have a symbiotic relationship with lycaenidae butterflies mainly through larvae tending by the ants. While six species, including one invasive exotic, *Linepithema humile*, and five native species, *Pogonomyrmex californicus. Messor andrei, Solenopsis xyloni, Prenolepis imparis* and *Camponotus semitestaceus*, were found at DFSP, only *L. humile* was found at Chandler, Three Sisters, Alta Vicente, and George F. Preserves. Further study should be done to determine which ant species could be good partners to help the *G. L. palosverdensis* survive.

113. DYNAMICS OF FECAL INDICATOR AND OTHER BACTERIA DURING VARYING TIDAL CONDITIONS IN DEL REY LAGOON, PLAYA DEL REY, CALIFORNIA

J.J. Huh, J.T. Valdez, and J. Dorsey. Leonetti-O'Connell Honors Research in Science, Loyola Marymount University and Marlborough School, Department of Natural Sciences, Los Angeles, CA, 90015 and 90004.

The primary focus of the project was to understand the dynamics of fecal indicator bacteria (FIB) in Del Rey Lagoon, Playa Del Rey, California, during ebb and flood tides. In order to approach this understanding, different tidal ranges were compared with respect to number of bacteria present during

ebb and flood tides. This analysis helped to determine whether the lagoon was a sink or a source of bacteria. Results showed that the lagoon tended to be a source during spring tides and a sink during neap tides. Furthermore, there was a strong correlation between the increase of turbidity and the increase of enterococci. Culturable species, which included FIB and non-FIB species, were also analyzed to see the diversity in the different water flows and to indicate any anthropogenic influences on bacterial sources within the lagoon system. Continuing research will assess whether the bacterial contributions are from anthropogenic sources, such as runoff, or from natural sources, such as bird feces.

114. AN INVESTIGATION OF RADIOISOTOPES AND E.COLI LEVELS IN SANTA MONICA BEACH

A.R. Kelleghan. Notre Dame Academy, Los Angeles, CA and University of Southern California, Los Angeles, CA.

This project was conducted to investigate the residence time of water along the beach and how the bacterial contamination is distributed due to water flux. Shoreline water and pore water from Santa Monica beach were sampled and the presence of radium, E.coli bacteria, and the salinity were examined. Water samples were collected at four points along the Santa Monica Beach during dry and wet weather. At the times that water flowed out of the storm drain, a water sample was collected at that location as well. Water samples were filtered through a radium cartridge and then analyzed on the RaDeCC counter for the presence of ^{223}Ra and ^{224}Ra. Water samples were also taken to measure salinity and the presence of coliform bacteria. Radium has been used as an indicator of water circulation. Larger amounts of ^{223}Ra and ^{224}Ra were found in the pore water than in the water column. The radium concentration in the pore waters was used to calculate the residence time of pore water in the sand before exchange with the shoreline waters. The results indicated that the residence time, averaging 0.4 to 1.7 days, is relatively short. High levels of E.coli bacteria in shoreline waters were correlated with rainfall. Without any rainfall, E.coli bacteria were not found in any of the water samples; however, bacteria were found in every sample during the rainy sampling periods. E.coli bacteria were found only in the water column, not in any of the pore water samples. It appears that groundwater flow through the pore water zone is not a major source of E. coli bacteria in the shoreline water.

115. THE EFFECT OF DENITRIFICATION ON METHANOGENESIS IN CONSTRUCTED WETLANDS

Sumit Mitra. University High School, Irvine, CA.

Wetlands are one of the most cost effective green tools for water treatment systems. However, they have a side effect. The various natural treatment processes in them produce gases like CH_4 (methane) and N_2O (nitrous oxide), both of which are greenhouse gases and are expelled from the wetlands. Nitrous oxide is not released in large quantities from wetlands but methane is, and it is produced by the anaerobic processes within the wetland substrate by methanogenic bacteria. The presence of sufficient quantities of nitrate can cause denitrifying bacteria to grow in wetland environments and thereby inhibit the methanogenic bacteria thus reducing methane emissions. To test this, we created six wetland eco system models in which *Scirpus americanus* (bulrush) were planted and were allowed to grow for 3 months and a control model without these plants. After that, equal amounts of glucose were added to all the models while potassium nitrate (a nitrate source) was added only to three models The models were then tested for BOD (via aqueous sampling) and N_2O vs. CH_4 emissions (via gas sampling). Nitrate concentration was also tested to determine denitrification in these models. The results supported the hypothesis that in the presence of nitrate, the denitrifying bacteria were able to displace the fermenting and methanogenic bacteria in the wetland models.

116. EFFECTS OF DROUGHT CONDITIONSON THE WATER RELATION AND PHOTOSYNTHETIC CO2 UPTAKE OF INVASIVE AND NATIVE PLANTS OF CALIFORNIA

Suh Y. Woo. Mentor Dr. Rasoul Sharifi, Teacher Peter Starodub, Research conducted at University of California, Los Angeles, Department of Ecology and Evolutionary Biology.

The most common plant community in southern California, the Coastal Sage Scrub Community, is diminishing rapidly as a result of urban and housing development. In addition, the drought in California causes water stress for native plants, subsequently causing invasive species to take water away from the native species. This study looked at how invasive and native plants deal with the drought conditions by studying assimilation, transpiration, plant water use, water-use efficiency, and water potential. A portable gas exchange system (LI-6400, LI-COR Inc., Lincoln, Nebraska, USA) was used to measure the maximum rates of net photosynthesis, stomatal conductance to water vapor, and water-use efficiency in one native species *Encelia California* and one invasive species, *Ageratina adenophora*. It was found that similar water-use efficiency of invasive plants and native plants may be identified as an important factor contributing to the success of the invasive species. *Encelia* has a slightly higher water use per canopy per area than *Ageratina adenophora*. *Ageratina adnophora's* water stress tolerance indicates that it competes well with the native plants during limited resources. Understanding the ecology and physiology of weedy species such as *Ageratina adenophora* will help better management of weedy species and conservation of native species.

117. MPP+ MEDIATES CALPAIN ACTIVATION IN PRIMARY NEURONS: A FLUORESCENT BASED ANALYSIS OF A PARKINSONIAN MODEL

Alexa Aranjo, Martin Byhower, Chadwick School, and Professor Michel Baudry. University of Southern California.

Parkinson's disease is a movement disorder characterized by trembling, stiffness, the slowness of movement, poor balance and coordination, and degenerative cognitive function, originating from the degeneration of dopaminergic neurons in the *substantia nigra pars compacta* region of the brain. Dopamine is a neurotransmitter; which, in these neurons, normally acts to send signals that help coordinate motor movements. MPP+ (C_{12} H_{12} N^{+}) is a toxin used commonly to model Parkinsonian systems in vitro. MPP+ accomplishes this through its positive charge on the nitrogen atom, causing an electrostatic disturbance in the dopaminergic neural circuits. In my study, primary E18 rat neurons were incubated with a fluorescent calpain substrate and then calpain activity was monitored in the presence of MPP+ and without MPP+. The calpain activity was analyzed quantifiably through a fluorospectrometric assay and visually through a fluorescent microscopy assay. My studies suggested that MPP+ mediates calpain activation in neurons; indicating that calpain is potentially involved in molecular mechanisms of Parkinson's disease. Calpain, when activated, can break down and reorganize the cell's cytoskeleton, which changes synapses in neural circuits.

118. CONSTRUCTION OF HUMAN RECOMBINANT IGA1 SPECIFIC TO M1 MANNAN ON *CANDIDA ALBICANS* CELL SURFACE

Elizabeth Hong, Nicole Johnson, and Mason Zhang, Ph.D. California State University Long Beach 1250 Bellflower Blvd, MICR 202E Long Beach, CA 92648.

Candida albicans is a yeast-like fungus that can cause life threatening disseminated candidiasis among immunocompromised and nosocomial patients. Current treatments include such drugs as fluconazole and polyene but has proved to be inadequate; therefore a new therapy is needed. Naturally occurring anti-*Candida* antibodies in the forms of IgG, IgA, and IgM are found in normal human serum. Recently, Dr. Mason Zhang's lab has constructed M1g1 antibody, an IgG1 antibody with an epitope binding domain specific to M1 mannan oligosaccharide on *C. albicans* cell surface. M1g1 has been shown to activate the human complement pathway and also enhances phagocytosis by human neutrophils. However, IgA1 antibodies role in protecting against candidiasis has yet to be studied. This report set out to construct human recombinant IgA1 specific to M1 mannan from previously constructed M1a2 (IgA2 antibody specific to M1 mannan derived from M1g1) and an IgA1 heavy chain vector. Both vectors were mutated to include appropriate restriction sites for digestion and ligation for a full M1a1 plasmid. The M1a2 vector was successfully mutated to include the necessary restriction sites and the IgA1 vector has undergone new mutagenesis to include the restriction site, but the gene has yet to be confirmed to have the necessary mutation.

119. EXTRACELLULAR WNT/B-CATENIN AUTOCRINE SIGNALING SUPPORTS A MALIGNANT PHENOTYPE EVEN WITHOUT INTRACELLULAR WNT PATHWAY MUTATION IN COLON CANCER

Andrius Planutis. University High School, Irvine, California, and University of California, Irvine, 3800 Parkview Lane #8B, Irvine, California 92612, pandryus@gmail.com

Abnormal Wnt pathway signaling is an early event in 90% of colorectal cancers. It is shown that inhibitors of extracellular signaling decrease the colon tumor growth in the absence of intracellular Wnt pathway mutations. The influence on epithelial mesenchymal transition and clonogenic cell numbers is not known. My goal is to study it, since at higher levels of Wnt signaling, in the presence of intracellular Wnt pathway mutation, the down-regulation by these inhibitors of clonogenic cell numbers is dramatic. Colon cancer cells RKO without known mutations in intracellular part of Wnt/β-catenin pathway have a low expression of both DKK1 and SFRP1 mRNA. Transfection of DKK1 and SFRP1 decreases the number of clones formed by RKO. Expression of DKK1 is present before transfection, and expression of SFRP1 is low enough to be restored by transfection in a second cell line HCT116B with knockout of the mutant β-catenin allele. SFRP1 decreases the number of clones formed by HCT116B. In correlation with the expression data the clone numbers are not changed by DKK1 in these cells. When the morphology is studied, RKO with inhibitors demonstrate an increase in cell-cell contact formation. This suggests a reversed epithelial mesenchymal transition and a less invasive phenotype. I conclude that DKK1 and SFRP1 show anticancer activity, including reversal of epithelial mesenchymal transition in RKO cells, however mostly through reduction of clonogenic cell numbers even at lower level of Wnt signaling, in the absence of mutations in intracellular part of Wnt/β-catenin pathway in both cell lines.

120. EFFECTS OF ALCOHOL CONSUMPTION ON LEFT VENTRICULAR FUNCTION AND CALCIFICATION

Wu, Helena (Hao), Teacher Peter Starodub, Mentor Dr. Budoff and Dr. Mao. Research conducted at Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center.

The purpose of this research was to obtain an accurate comparison of cardiac functions of patients who consume alcohol and those who do not. Alcohol is a highly toxic substance and when ingested frequently, can cause health complications that are characterized by changes in volume, mass, and ejection fraction of the left ventricle. Previous techniques for achieving measurements of the heart relied on echocardiography (ultrasound). This study focuses on the use of Computed Tomography (CT) for precisely determining differences between non-alcoholic and alcoholic hearts.

340 patients (79% Males, 61% consume 1–3 alcoholic drinks per day) who underwent thoracic CT protocol were selected for analysis. Patients with previous history of cardiovascular disease were excluded from the study. Images were analyzed on the GE Advantage Workstation 4.4 and 4.6. The ejection fraction, volume and mass of the left ventricle were calculated with the software program titled Reformat. Calcification of the coronary arteries was measured using the Calcium Score function. *T*-tests were performed and histograms were constructed for statistical analysis.

The data collected from the patient population revealed differences between non-alcoholic and alcoholic hearts. Results indicated that the left ventricles of alcoholic patients were larger in volume, higher in mass, and lower in ejection fraction, compared to non-alcoholic patients. Calcification was also higher in patients who regularly consume alcohol.

It was concluded that CT scans validated the results from echocardiography and provide a more in-depth understanding of the exact correlation between alcohol and heart health. The measurements can be utilized as a standard of comparison to detect abnormalities in volume, mass, ejection fraction, and calcification of the heart, which can be the first signs of alcohol related diseases such as cardiomyopathy and myocardial infarction. These guidelines can assist doctors in making early and noninvasive diagnosis of heart disease.

121. IMPROVING ELEVATOR SCHEDULING EFFICIENCY BY IMPLEMENTING A SMARTER CONTROLLER

Kenny, Lei. Walnut High School, 400 N. Pierre Road, Walnut, CA 91789. California State Polytechnic University, Pomona, 3801 W. Temple Avenue, Pomona, CA 9176.

This research considers how efficiently elevators in tall buildings can deliver passengers to their intended destinations. The director behind this process is the elevator controller, which evaluates many possible delivery scenarios and decides the most efficient plan. The problem is relatively simple when the scale of operation is small, but as the number of floors and elevator cars increases, the number of possible plans grows tremendously. This project's objective is to create a smarter elevator controller designed to reduce the average waiting time (AWT), based on the Empty the System Algorithm (ESA), which calculates and minimizes expected waiting times over all passengers using a system of elevators. Due to the complex and costly nature of using and testing real elevator systems, this controller was implemented in an elevator simulator program. Software was developed by integrating the smarter controller into an existing simulator called ElevatorSim, which was written in the Java programming language. The smarter controller was written with five Java methods expected by the simulator. The most important Java method computes for the best car for each car request using an AWT formula created in this project. Over 10,000 elevator simulation trials were performed with ElevatorSim, and the AWT for the smarter controller was compared against the AWT for ElevatorSim's default controller. Observations show that the smarter elevator controller outperforms ElevatorSim's default controller by an average of 12 percent, significantly reducing passenger waiting time. This smarter controller can be applied to real elevator systems and improve elevator efficiency.

122. PROPARGYL METHYL ETHERS: NOVEL PRECURSORS TO COBALT-COMPLEXED PROPARGYL CATIONS

Sarine Shahmirian and Gagik G. Melikyan. California State University Northridge, Department of Chemistry and Biochemistry, Northridge, CA, 91330.

The generation of transition metal-stabilized organic cations under *neutral conditions* has long been sought after in the field of organometallic chemistry. Traditionally, unsaturated organic ligands are treated with strong Lewis acids, such as tetrafluoroboric acid (HBF_4). This method, however, is inapplicable for substrates containing functional groups sensitive to acids, in particular benzyloxy and acetal groups. The novel method for the generation of $Co_2(CO)_6$-complexed propargyl cations *under neutral conditions* was developed: employing the metal-bonded methyl propargyl ethers as substrates and triflic anhydride as a reagent. Ionic propargyl triflates are formed *in situ* as intermediates, due to successive nucleophilic substitution reactions. The transition of these reactive intermediates to the respective propargyl radicals readily occurs at 83°C (3–6 min), by way of the cluster-to-cluster and cluster-to-ligand single electron transfers. The carbon-carbon formation alpha to the metal clusters affords polysubstituted 3,4-diaryl-1,5-alkadiynes in high yields (>80%) and excellent *d,l*-diastereoselectivity (89–97%). The scope of the reaction was expanded by involving topologically diverse propargyl ethers, particularly those containing methoxy groups on the periphery of the aromatic nuclei.

123. *EQUUS* MATERIAL FROM THE LA HABRA FORMATION, RALPH B. CLARK REGIONAL PARK, BUENA PARK, ORANGE COUNTY, CALIFORNIA.

M.K. Crowe, L. Babilonia, and Ralph B. Clark Regional Park, Interpretive Center, 8800 Rosecrans Ave. Buena Park, CA, 90621.

Excavation at the former 1997 "Tony the Pony" excavation site during the 2008–2009 Field season at Ralph B. Clark Regional Park, Buena Park, California yielded twelve associated fossil *Equus* teeth and other bone fragments of long bones, and individual carpal, and tarsal bones. The specimens are from the La Habra Formation, which ranges from late Irvingtonian to early Rancholabrean in age. Water-screening of matrix from the site yielded microfossils that included fresh water snails, slugs, bony fish, *Clemmys sp.* (pond turtle), *Microtus* (vole), *Thomomys sp.* (pocket gopher), and possibly other rodents; this deposition may indicate that these sediments were deposited in a lacustrine environment. The material was measured, documented, categorized and analyzed. The results of this find were compared with those of previous excavations and research. The material found during the excavation season from September 2008 to March 2009 remained consistent with the previous documented results. The prior excavation, in 1997, yielded a partial upper maxilla and several foot bones of *Equus tau*. This original material was compared to the *Equus* material found in the current season. The morphological and physical differences between the two strongly indicate that the "Tony the Pony" excavation site contains at least two different horse specimens.

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The BULLETIN is published three times each year (April, August, and December) and includes articles in English in any field of science with **an emphasis on the southern California area**. Manuscripts submitted for publication should contain results of original research, embrace sound principles of scientific investigation, and present data in a clear and concise manner. The current AIBS *Style Manual for Biological Journals* is recommended as a guide for contributors. Consult also recent issues of the BULLETIN.

MANUSCRIPT PREPARATION

The author should submit at least two additional copies with the original, on 8½ × 11 opaque, nonerasable paper, double spacing the entire manuscript. Do not break words at right-hand margin anywhere in the manuscript. Footnotes should be avoided. **Manuscripts which do not conform to the style of the BULLETIN will be returned to the author.**

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A feature article comprises approximately five to thirty typewritten pages. Papers should usually be divided into the following sections: abstract, introduction, methods, results, discussion and conclusions, acknowledgments, literature cited, tables, figure legend page, and figures. Avoid using more than two levels of subheadings.

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Abbreviations: Use of abbreviations and symbols can be determined by inspection of a recent issue of the BULLETIN. **Omit periods after standard abbreviations:** 1.2 mm, 2 km, 30 cm, but Figs. 1–2. Use numerals *before* units of measurements: 5 ml, but nine spines (10 or numbers above, such as 13 spines). The metric system of weights and measurements should be used wherever possible.

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The literature cited: Entries for books and articles should take these forms.

McWilliams, K. L. 1970. Insect mimicry. Academic Press, vii+326 pp.

Holmes, T. Jr., and S. Speak.1971.Reproductive biology of Myotis lucifugus. J. Mamm., 54:452–458.

Brattstrom, B. H.1969.The Condor in California. Pp. 369–382 in Vertebrates of California. (S. E. Payne, ed.), Univ. California Press, xii+635 pp.

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